REGION 1

RECORD OF DECISION

BEEDE WASTE OIL SUPERFUND SITE

PLAISTOW, NEW HAMPSHIRE

JANUARY 2004

PART 1: THE DECLARATION

PART 2: THE DECISION SUMMARY

DECLARATION FOR THE RECORD OF DECISION

A. SITE NAME AND LOCATION

Beede Waste Oil Superfund Site
7 Kelley Road
Plaistow (Rockingham County), New Hampshire
CERCLIS ID# NHD018958140
Site ID# 0102723
NPL Final 12/23/96

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Beede Waste Oil Superfund Site (the "Site"), in Plaistow, New Hampshire, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this Record of Decision.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Plaistow Public Library (electronic format only) and at the United States Environmental Protection Agency (EPA) Region 1 OSRR Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix E to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of New Hampshire concurs with the selected remedy.

C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for all operable units at the Site, which involves source control activities including the removal of contaminated soil and sediment for off-Site treatment or disposal and the treatment of deeper soils through the use of soil vapor extraction, which may be thermally-enhanced, and management of migration activities including extraction and on-Site treatment of groundwater with limited areas of natural attenuation. Long-term monitoring of groundwater and surface water will be necessary to ensure the effectiveness of the remedy. Institutional controls will be established to permanently prevent excavation of deep soils (i.e., greater than ten feet below ground surface), and to temporarily prevent ingestion of groundwater until restoration to drinking water standards is achieved. This remedy is intended to address the principal human health and ecological threats by removing all known sources of contamination and actively treat groundwater to prevent further plume migration and ultimately restore the aquifer to drinking water standards. Following completion of the remedy, the anticipated future use of the Site is for residential and recreational development. The selected remedy is a comprehensive approach for the Site that addresses all current and potential future risks caused by soil, sediment, groundwater and surface water contamination.

Specifically, this remedial action includes the excavation and off-Site treatment or disposal of approximately 80,000 cubic yards of contaminated soil. The soil materials are primarily contaminated with polychlorinated biphenyls (PCBs) and lead that are being removed to a depth of ten feet below ground surface to prevent human contact and allow for future redevelopment of the Site. Soils at a depth greater than ten feet below ground surface will be treated by soil vapor extraction to remove volatile organic compounds (VOCs), which are an ongoing source of groundwater contamination. The soil vapor extraction (SVE) system may require thermal enhancement for effective VOC removal[1].

Groundwater is contaminated with various VOCs and will be extracted from the overburden aquifer. Point-of-use treatment systems have already been placed on the well-heads of three residential properties and these systems will need to be maintained to ensure continued safe potable water until completion of the remedy.

<u>The major components of this remedy are:</u>

1. Construction of an on-Site groundwater extraction and treatment system.

2. Excavation and off-Site treatment or disposal of contaminated surface and sub-surface soil and limited sediment.

3. Construction of a soil vapor extraction system to treat deep soil, which may include thermal-enhancement through steam injection.

4. Establishment of Activity and Use Restrictions (AURs) to prevent the excavation of soil deeper than 10 feet beneath ground surface.

5. Establishment of a Groundwater Management Zone in accordance with State of New Hampshire law to prevent consumption of groundwater.

[1]A field-scale pilot study will be performed to determine the appropriateness of applying thermal enhancement to the SVE system. Cost estimates for the relevant source control alternatives include thermal enhancement.

6. Implementation of a long-term groundwater monitoring program to evaluate remedy effectiveness and monitor quality in area drinking water supply wells.

7. Implementation of a long-term surface water and sediment monitoring program to evaluate remedy effectiveness and natural attenuation progress in Kelley Brook.

8. Completion of the ongoing non-time critical removal of mobile oil product from the water table.

This remedy follows successful completion of a joint EPA and Department of Environmental Services (DES) emergency removal of all bulk stored waste from the Site from 1996 to 1997, and builds on the current non-time critical removal of mobile light non-aqueous phased liquids started by EPA in 2000. This remedy is a comprehensive approach and no further operable units are anticipated at this Site.

The selected response action addresses principal and low-level threat wastes at the Site by: removal of source soils and sediments; elimination of leachate from deeper soils through treatment; and restoration of the aquifer to drinking water quality through treatment; and limited natural attenuation.

E. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment). Groundwater and deep soils (greater than 10 feet below ground surface) will be actively treated on-Site. Surface and sub-surface soils will be excavated and sent off-Site for final disposition.

Because this remedy will result in hazardous substances remaining on-Site above levels that allow for unlimited use and unrestricted exposure, institutional controls are necessary, and a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

F. SPECIAL FINDINGS

Issuance of this ROD embodies specific determinations made by the Regional Administrator pursuant to CERCLA and the following ARARs:

- Section 761.61(c) of the Toxic Substances Control Act (TSCA);
- Section 404 of the Clean Water Act;
- Executive Order 11988 for Floodplain Management; and
- Executive Order 11990 for Protection of Wetlands.

Under the Toxic Substances Control Act (TSCA), the Regional Administrator, EPA Region 1, finds that the Site meets the standards of 40 CFR 761.50 for remediation and that the selected remedy will not pose an unreasonable risk of injury to health or the environment pursuant to 40 CFR 761.61(c). Under Section 404 of the Clean Water Act, the Regional Administrator finds that the selected remedy which involves the excavation of materials from the Kelley Brook wetland is the least damaging practicable alternative for protecting the Kelley Brook aquatic ecosystem under the standards of 40 CFR Part 230.

Further, under Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands), the Regional Administrator finds that there is no practicable alternative to the selected remedy which would have less adverse impact on the Kelley Brook floodplain or wetland. Mitigation activities, such as erosion control, will be performed to minimize necessary impacts and the floodplain and wetland will be restored.

G. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

1. Chemicals of concern (COCs) and their respective concentrations. ✔

2. Identification of principal and low-level threats. ✔

3. Baseline risks represented by the COCs. ✔

4. Cleanup levels established for COCs and the basis for the levels. ✔

5. Current and future land and groundwater use assumptions used in the baseline risk assessment and ROD. ✔

6. Reasonably anticipated land and groundwater uses that will be available at the Site as a result of the selected remedy. ✔

7. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected. ✔

8. Decisive factor(s) that led to selecting the remedy including potential human health risks, the designation of the aquifer which underlies the Site as "high value" and the reasonably anticipated future use of the Site. ✔

H. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for soil, sediment, groundwater and surface water for all operable units at the Beede Waste Oil Superfund Site. This remedy was selected by EPA with concurrence of the State of New Hampshire Department of Environmental Services.

In approval of the Toxic Substances Control Act (TSCA) finding only,

By: Ira W. Leighton Date: 1/9/04

Ira W. Leighton, Deputy Regional Administrator
U.S. Environmental Protection Agency - Region I
for Robert Varney, Regional Administrator

In approval of the Record of Decision,

By: Susan Studlien Date: 01/09/04

Susan E. T. Studlien, Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency - Region I

A. SITE NAME, LOCATION AND BRIEF DESCRIPTION

- Beede Waste Oil Superfund Site
  7 Kelley Road
  Plaistow, New Hampshire
  (Rockingham County)

- CERCLIS ID#NHD018958140
  Site ID#0102723

- EPA Lead ROD
  State of New Hampshire Lead RI/FS

- Former Waste Oil Recycling Facility

- Brief Site Description

The Beede Waste Oil Superfund Site (the "Site") is located at 7 Kelley Road in Plaistow, New Hampshire. The Site occupies approximately 40.6 acres and is comprised of two parcels. Parcel 1 (21.6 acres) is owned by Hampshire Realty Trust and has been the location of petroleum and waste oil storage/handling/recycling since the 1920's. Parcel 2 (19 acres) is owned by Sun Realty Trust and has been used largely for commercial sand and gravel operations. Access to Parcel 1 is restricted by a chain link fence which surrounds the former operations area, except for a portion of the boundary with Parcel 2. Access to Parcel 2 is restricted by a chain link fence along the eastern boundary and Kelley Brook to the north and west. The Site has frontage on Kelley Road and Old County Road. All access to the Site is from Kelley Road since access to Old County Road is restricted by Kelley Brook.

Parcels 1 and 2 are both zoned as medium density residential property. The abutting properties in the vicinity of the Site are primarily residential. The topography of Parcel 1 is relatively flat, except the northern boundary which slopes gently down to Parcel 2. The topography of Parcel 2 has been altered by former sand and gravel mining operations. The 10,000 square foot former operations building remains on Parcel 1. Most of the Site is unpaved, except for a parking area adjacent to the building. A majority of the Site is open and unvegetated, except for some wooden areas around the perimeter. A Site location map is provided as Figure 1. Site features are depicted on Figure 2.

A more complete description of the Site can be found in Section 1.2 of the Remedial Investigation Report (Sanborn, Head & Associates, February 2001).

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

Commercial operations including recycling of used oil, and storage and distribution of virgin fuel oil reportedly started in 1926. Cash Energy, Inc., Beede Waste Oil (BWO), Industrial Fuels Corporation (IFC) and related subsidiaries and affiliates operated at the Site from 1962 to 1994. The waste oil recycling operations were regulated by the New Hampshire Department of Environmental Services (DES) under their waste oil program.

Modern operations at the Site began in the 1950's with the installation of a 140,000 gallon underground storage tank (UST) and several above ground storage tanks (ASTs). Additional USTs and ASTs were added throughout the 60's, 70's and 80's. A one-acre unlined lagoon was observed during the mid to late 1960's. The exact number of USTs and ASTs that were present on-Site remains unknown. The owner reportedly removed eight USTs in 1989. In 1991, the owner removed three additional USTs including the 140,000 gallon UST which had been leaking waste oil. Nearly 100 ASTs were observed on-Site following closure of the facility in 1994. Most ASTs were railroad tanker cars sitting directly on the ground (unlined) and used for waste oil storage. Most ASTs were connected by subsurface piping, reportedly for waste oil blending. A few ASTs were reportedly used for virgin fuel oil and gasoline storage. Over 800 drums were also observed in 1994. The tanks and drums had a combined storage capacity of about 3 million gallons. Seventeen large soil piles were also abandoned on-Site. Most of these soil piles reportedly originated from off-Site petroleum UST removals and were intended for use in an on-Site asphalt batching process which operated for a short time in the early 1990's.

Contamination on the Site originated from poor storage and handling of waste oil and other products as well as the unlined and uncovered storage of large contaminated soil piles. Elevated concentrations of polychlorinated biphenyls (PCBs) were first detected by DES in waste oil found in several ASTs as part of a compliance inspection in August 1988. Numerous notices and a Superior Court order to cease operations and perform investigation and remedial activities were issued from 1988 to 1992. The presence of product contamination in several of the ASTs at the Site was first referred to EPA Region I in 1993.

A more detailed description of the Site history can be found in Section 1.2 of the Remedial Investigation Report.

2. History of Federal and State Investigations and Removal and Remedial Actions

The Site has a long history of regulatory oversight and response actions. The New Hampshire Department of Environmental Services ("DES") first became involved with the Site in response to a compliance inspection performed in 1988. Numerous inspections followed resulting in the issuance of violations and orders to the Site's owners. In 1992, DES began to perform on-Site activities to control releases of oil to Kelley Brook. Then in 1993, DES began to perform on-Site investigations and covered the soil piles. More extensive investigations were performed by DES in 1995. EPA began investigations in 1993 leading to inclusion of the Site on the National Priorities List (NPL) in 1996. EPA and DES completed a joint removal of all abandoned liquid wastes from the Site in 1997. EPA initiated a non-time critical removal action in 1998 to remove mobile contaminated oil from the groundwater table. DES initiated an EPA funded remedial investigation (RI) in 1997, leading to a final RI report, issued in 2001. DES completed an EPA funded feasibility study (FS) in early 2002. EPA issued a proposed plan for cleanup in June 2002.

The following table summarizes all major EPA and DES investigation and cleanup activities at the Site to date.

Major EPA and DES Activities

Date	Action	Legal Authority	Who	Results	Related Documents
August 1988	Oil product inspection	RSA 146-C	DES Oil	Non-compliance. Elevated PCBs found..	NH Site file RI Report
June 1990	Supply well sampled	RSA 485-C	DES Water	Benzene above MCLs. Alternate water supply provided (WS-2).	NH Site file RI Report
April 1991	Site inspection	RSA 125-C	DES Air	Permit violations. Required to cease asphalt operations.	NH Site file RI Report
April 1991	Administrative Order	RSA 125-C	DES Air	Beede ordered to: 1. Cease receipt of all wastes. 2. Cease processing soil into cold patch. 3. Conduct audit of soil. 4. Submit compliance plan.	Admin. Order #ARD-91-011. Temp. Permit #TP-BP-326 NH Site file
October 1991	Administrative Order	RSA 147-A RSA 149-M	DES Waste	Beede ordered to: 1. Cease receipt of all wastes. 2. Dispose of existing wastes. 3. Discontinue haz-waste and used oil transportation.	Admin. Order #WMD 91-33 NH Site file RI Report
November 1991	Administrative Order	RSA 146-A RSA 146-C RSA 485-A	DES Oil and Water	Beede ordered to: 1. Remove free-product oil from groundwater. 2. Monitor area supply wells and surface water. 3. Verify location of floor drains.	Admin. Order #WSPCD 91-29 NH Site file RI Report

Date	Action	Legal Authority	Who	Results	Related Documents
July 1992	Administrative Order	RSA 125-C	DES Air	Beede ordered to: 1. Cease asphalt operations. 2. Correct permit violations noted in April 1991.	Admin. Order #ARD 92-016 NH Site file RI Report
November 1992	Civil enforcement action filed in Rockingham County court	RSA 146-A RSA 146-C RSA 147-A RSA 147-B RSA 149-M	NH AGO	Requested civil penalties and injunctive relief for numerous violations.	Docket #92-E-542 NH Site file RI Report
December 1992	Preliminary injunction issued by Rockingham County court	RSA 146-A RSA 146-C RSA 147-A RSA 147-B RSA 149-M	Rock. County Court and NH AGO	Required all defendants to: 1. Remove free product oil from groundwater and surface water. 2. Monitor area supply wells. 3. Provide alternate supply wells, as needed. 4. Maintain soil piles. 5. Conduct investigation and develop remedial action plan.	Docket #92-E-542 Court Order - 12/14/92 RI Report
January 1993	Oil absorbent booms installed on Kelley Brk	RSA 146-A RSA 146-C Court Order	DES Oil	Oil discharge to Kelley Brook controlled.	NH Site file. RI report
January 1993	Initiated free-product recovery effort	RSA 146-A RSA 146-C RSA 485 - C Court Order	DES Oil Water	About 7,900 gallons of haz. waste and water removed from 12/03 to 5/94.	NH Site file RI report
June 1993	Soil piles covered with tarps.	RSA 147-A Prelim. Injun. Order	DES Waste	Off-site migration of contaminated soil particles prevented.	NH Site file RI report
September 1993	Removal assessments	CERCLA	EPA	Tested several ASTs for hazardous waste.	Roy F. Weston report
December 1993	Site placed on CERCLIS	CERCLA	EPA	NPL listing investigation begins.	Admin. Record #4 of 4

Date	Action	Legal Authority	Who	Results	Related Documents
January 1994	Document review and Site investigation	RSA 147-A RSA 485-C Prelim. Injun. Order	DES Waste Water	(1) Summarized all previous federal, state and owner studies. (2) Sampling confirmed the presence of NAPL and VOC plumes.	Haley & Aldrich Report (1994)
April 1994	Preliminary Assessment & Site Inspection	CERCLA	DES Waste	Results used to determine Hazard Ranking Score for NPL listing.	Prelim. Assess. Report (1994) Site Inspection Report (1995)
August 1994	Surface water and sediment sampling	CERCLA	EPA	Results indicated oil/water contained PCBs at 50 to 3,300 ppb; oil/sediment at 4 to 20 ppm.	Admin. Record #1 of 4
December 1994	Free-product (LNAPL) sampling	CERCLA	EPA	Confirmed oil contained PCBs, VOCs, PAHs and lead.	Weston (1995)
February 1995	Point-of-entry treat. system installed	RSA 147-A	DES Waste	Supply well treated to provide clean water to condo units.	NH Site files
February 1995	Sediment sampling	CERCLA	EPA	Information used in Site inspection report.	CDM (1995)
February 1995	Significant Site characterization	RSA 485-C Prelim. Injun. Order	DES Water	Multi-media investigation determined general extent of contamination.	SHA (1995)
May 1995	Civil order issued	Court Order	County Court & NH AGO	DES and its contractors were provided access to the Site.	Docket #92-E-542 Court Order 5/5/95 RI Report
December 1995	Vertical ASTs sampled	RSA 146-A	DES Oil	4 ASTs were empty. 5 contained oil, water and sludge.	SHA (1996)
June 1996	Site proposed for NPL inclusion	CERCLA	EPA	Site eligible for CERCLA funds. Public comment on proposed listing.	Admin. Record #4 of 4
July 1996	Action Memorandum I	CERCLA	EPA	Emergency Removal of bulk RCRA/TSCA hazardous wastes.	Action Memorandum, July 12, 1996

Date	Action	Legal Authority	Who	Results	Related Documents
October 1996	Civil forfeiture action	RSA 147-A	DES Waste	Court Order allowing removal of waste oil.	NH Site files
October 1996	Point-of-entry treat. systems installed	RSA 147-A	DES Waste	Treatment systems installed at well head to provide potable water to 3 abutters.	NH Site files
November 1996	Removal of bulk wastes	RSA 147-A	DES Waste	Removal of all bulk non-RCRA/TSCA wastes.	SHA (1997) SHA (1998) NH Site files
December 1996	Site finalized on NPL	CERCLA	EPA	EPA prepares for RI/FS and PRP search.	Admin. Record #4 of 4
March 1997	Remedial Investigation begins	CERCLA	DES Waste	DES issues the scope of work to Sanborn, Head & Associates.	Beede RI SOW (1997)
March 1997	PRP search begins	CERCLA	EPA	EPA issued 104(e) Information Request Letters to about 7,500 parties from '97 to '99.	Administrative Record #4 of 4
November 1997	Oil Interceptor Trench Installed	CERCLA	EPA	100' trench installed along Kelley Brook to cut-off oil seepage.	Administrative Record #3 of 4
September 1998	Action Memorandum	CERCLA	EPA	Initiates Non-Time Critical Removal Action design.	Action Memorandum (1998)
February 2001	RI Report	CERCLA	DES Waste	Documents Site characterization and risks.	RI Report
June 2001	General Notice	CERCLA	EPA	Notices of liability sent to about 2,000 PRPs.	Administrative Record #3 of 4
November 2001	1st *deminis* settlement offer	CERCLA	EPA	Settled with 496 PRPs.	Administrative Record #3 of 4
January 2002	FS Report	CERCLA	DES Waste	Documents technology assessments and remedial alternatives.	FS Report, January 2002
November 2002	2nd *deminims* settlement offer	CERCLA	EPA	Settled with 415 PRPs.	Administrative Record #3 of 4
June 2002	Proposed Cleanup Plan	CERCLA	EPA	Documents EPA's intended cleanup plan and starts a 60 day public comment period.	Proposed Plan

Date	Action	Legal Authority	Who	Results	Related Documents
September 2002	Reuse Pilot Grant	CERCLA	EPA	Provided funds for Plaistow to develop a reuse plan for the Site.	Grant #SR-98170601
December 2003	3rd *deminimis* settlement offer	CERCLA	EPA	Settled with 12 PRPs on an ability to pay basis.	Administrative Record #3 of 4

3. History of CERCLA Enforcement Activities

On July 2, 1996, EPA notified three parties who either owned or operated the Beede Waste Oil and Cash Energy, Inc. facility of their potential liability with respect to the Site. On June 1, 2001, EPA sent general notice letters to approximately 2,000 additional parties identified as generators, arrangers or transporters of waste at the Site.

EPA has since entered into three separate settlements with various groups of these parties; the first *deminimis* settlement with 496 parties who EPA determined sent between 276 and 1,000 gallons to the Site; the second *deminimis* settlement with 415 parties that EPA determined sent between 276 and 5,000 gallons to the Site; and a third deminimis settlement with 12 parties on an ability to pay basis. The money recovered from these settlements, about $6.3 million, has been deposited into a special account to help finance Site cleanup. The remaining parties have formed informal groups and have expressed an interest in the remedy through comments on the Proposed Plan. The Responsiveness Summary included as Part 3 of this document contains the complete text of all comments received during the public comment period on the Proposed Plan and a written summary of EPA's responses.

The natural resource trustees have yet to issue any damage assessments. There is currently no known active litigation associated with this Site.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has been high. The EPA and DES have kept the community and other interested parties apprized of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

- In September 1997, EPA released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.

- On November 19, 1996, EPA and DES held an informational meeting at the Timberlane Regional High School auditorium to describe the plans for the Remedial Investigation and Feasibility Study.

- On June 16, 1998, EPA and DES held an informational meeting in the Vic Geary Community Center to discuss the planned non-time critical removal action and progress with the Remedial Investigation.

- On December 6, 2000, EPA and DES held an informational meeting in the Vic Geary Community Center to discuss the results of the Remedial Investigation and plans for the Feasibility Study.

- On June 19, 2002, EPA made the administrative record available for public review at EPA's offices in Boston and at the Plaistow Public Library. This is the primary information repository for local residents. EPA also maintains a complete electronic copy of the administrative record on its regional web site.

- On June 17, 2002, EPA published a notice and brief analysis of the Proposed Plan in the Manchester Union Leader, the Nashua Telegraph and the Rockingham News and made the plan available to the public on the regional web site and at the Plaistow Public Library. EPA widely distributed a press release to newspapers throughout New Hampshire, Massachusetts and Rhode Island announcing the preferred remedy and public informational meeting since the potentially responsible parties (PRPs) are located throughout these three states. EPA also distributed flyers to Site abutters inviting their participation in the public informational meeting and hearing.

- From June 19 to August 19, 2002, EPA held a sixty (60) day public comment period on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public and contained in the Administrative Record for the Site.

- On June 26, 2002, EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan to a broader community audience than those that had already been involved at the Site. At this meeting, representatives from EPA and DES answered questions from the public.

- On July 17, 2002, EPA held a formal public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the Agency's response to comments are included in the Responsiveness Summary, which is part of this Record of Decision.

- Throughout the remedial investigation and feasibility study process, EPA met with the Plaistow Board of Selectmen in public session to discuss reasonably anticipated future land use at the Site. In September 2002, the Town was issued a reuse grant by EPA to further evaluate future land use options. The Town distributed a land use survey and, from October 2002 through May 2003, conducted a series of six public meetings to solicit input from stakeholders including Site abutters and PRPs.

- EPA conducted regular meetings with the Board of Selectmen in public session to keep them informed of Site progress. EPA also met occasionally with residents and responded to numerous phone calls and emails. Regular fact sheets or updates were prepared throughout the five year remedial investigation and feasibility study. EPA maintains a Beede specific web site, www.epa.gov/region01/superfund/sites/beede, which has been continually updated with technical and enforcement information.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy was developed by combining components of different source control and management of migration alternatives to obtain a comprehensive approach for Site remediation. In summary, the remedy provides for the excavation and off-Site treatment or disposal of all contaminated soil down to a depth of ten feet; the treatment of soil greater than ten feet below ground surface for the removal of volatile organic compounds (VOCs) through the use of soil vapor extraction (which may be thermally-enhanced through steam injection); and the extraction and treatment of contaminated groundwater through an on-Site treatment system. This approach will remove the immediate threat of direct contact with contaminated soils, eliminate ongoing sources of surface and groundwater contamination, and ultimately restore the aquifer to drinking water standards.

Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The principal and low-level threats that this ROD addresses are summarized in the following table:

Principal Threats	**Medium**	**Contaminant(s)**	**Action To Be Taken**
Direct contact	Shallow soil (0 to 10 ft)	PCBs/Lead	Excavate and treat or dispose off-Site
Highly mobile	Deep soil (> than 10 ft)	VOCs	In-situ treatment
Ingestion Highly mobile	Groundwater	VOCs	Extract, treat and re-infiltrate

Low-Level Threats	Medium	Contaminant(s)	Action To Be Taken
Direct contact	Sediment	PCBs/PAHs	Excavate and treat or dispose off-Site
Ecological (food chain)	Surface water	VOCs/PAHs	Monitor

E. SITE CHARACTERISTICS

Section 1.4 of the Feasibility Study Report contains a comprehensive overview of the Remedial Investigation. The significant findings of the Remedial Investigation are summarized below. Refer to the Remedial Investigation Report for complete details.

In March 1997, EPA entered into a Cooperative Agreement with the New Hampshire Department of Environmental Services (DES) through which Sanborn, Head & Associates were contracted to conduct a Remedial Investigation (RI). The principal objectives of the RI were to: (1) identify the nature and extent of contamination; (2) identify and quantify fate and transport mechanisms; and (3) quantify the human health and ecological risks resulting from Site contamination. The RI expands upon previous investigations which had been performed by the Site owner, EPA and DES and provides a comprehensive evaluation of Site conditions. Extensive field activities were completed as part of this effort including:

- A multi-phase soil sampling and analysis program encompassing about 330 samples.
- An overburden hydrogeologic investigation through which 70 new monitoring wells were installed and, along with 120 pre-existing monitoring wells, sampled.
- A bedrock hydrogeologic investigation through which one new bedrock well was installed and, along with six pre-existing water supply wells, sampled. All seven wells were logged for physical characteristics by the United States Geological Survey.
- Ongoing analysis of groundwater from about 70 area residential supply wells.
- Evaluation of surface water, sediment and wetland conditions in Kelley Brook, through which 14 staff gauges were established for measuring surface water levels and samples were collected and analyzed from 11 surface water and 36 sediment locations.
- Additional investigations of potential waste disposal areas including the performance of a soil gas survey under the former operations buildings and the excavation of multiple test pits from the former leachfields and landfill areas.

The sources of contamination, release mechanisms and exposure pathways to receptors of groundwater, surface water, sediments, and soils, as well as other Site-specific factors, are discussed below as part of a Conceptual Site Model (CSM). The CSM is a three-dimensional "picture" that documents current and potential future Site conditions and shows what is known about human and environmental exposures through hazardous substance release and migration to potential receptors. The risk assessment and response action for the Beede Site are both based on this CSM.

1. Conceptual Site Model

The former Beede Waste Oil Company operated primarily as a waste oil recycler. Other activities performed at the former facility include the production of cold-patch asphalt from petroleum contaminated soil, anti-freeze recycling and illegal dumping of solid waste. The RI concludes that petroleum contaminated wastes including PCBs, PAHs, VOCs, lead and various other contaminants leaked from above and underground storage tanks located throughout the former operations area. Spills also resulted from poor handling of petroleum wastes.

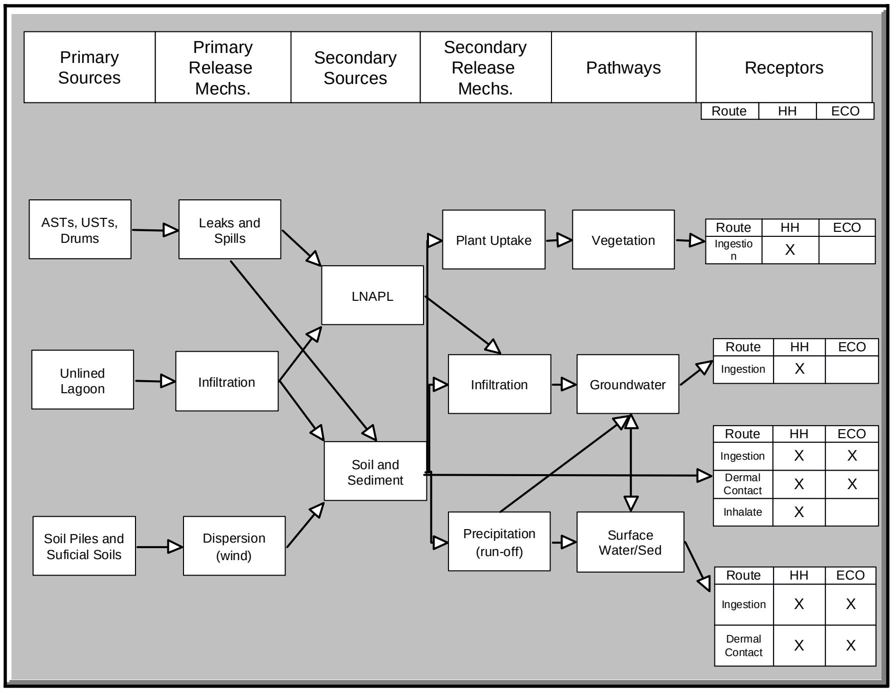
Additionally, in general, leaks and spills from the following areas are the primary sources of contamination at the Site;

- About 100 above-ground storage tanks (ASTs) with a combined storage capacity of nearly 2 million gallons (each tank capacity ranging from 5,000 to100,000 gallons).
- A 140,000 gallon underground storage tank (UST) and an unknown number of smaller USTs.
- An unlined waste lagoon (approximately 1 acre).
- About 800 drums (about 40,000 gallons).
- Surface soils throughout the former operations area.
- A solid waste landfill (approximately 1 acre).
- 12 large volume soil piles.

These leaks and spills combined to contaminate surficial soils, in some cases to the point of saturation, which became a major secondary source of groundwater contamination. Leachate from these soils combined with leachate from the lagoon area resulting in contamination of the underlying groundwater aquifer. These significant sources also resulted in the formation of a pool of light-non aqueous phased liquids (LNAPL) which collected on top of the drinking water table over an area of about four acres. The LNAPL was six feet thick in some areas and became another major secondary source of groundwater contamination. The contaminated soils leachate and LNAPL also reached Kelley Brook, contaminating surface water, sediments and wetland vegetation. The large soil piles were uncovered and exposed to the elements resulting in the spread of contamination to soils and sediment through dispersion and ongoing precipitation. The primary and secondary sources of contamination are presented in detail in Section 5.0 of the RI report.

These primary and secondary source areas combine to present unacceptable inhalation, ingestion and dermal contact risks to human and ecological receptors in the immediate vicinity of the Site. Specifically, a large area of surficial soil in the former operations area and a limited area of sediment in Kelley Brook present an unacceptable risk to human trespassers and future residents. Groundwater presents an unacceptable ingestion risk to existing abutter residents and future on-Site residents. Certain plant types in Kelley Brook, such as loosestrife, were also shown to uptake contamination, presenting a potential risk to birds and small mammals. In addition, the ecological risk assessment concluded that surface water in Kelley Brook presented an increased risk to fish, birds and small mammals through the food-chain pathway.

The flow diagram below depicts this Conceptual Site Model.



Conceptual Site Model

2. Site Overview

The Beede Waste Oil Site property is located at 7 Kelley Road in Plaistow, New Hampshire. A Site vicinity plan is attached as Figure 1.2. The Site property occupies approximately 40.6 acres and is comprised of two parcels. Parcel 1 (approximately 21.6 acres), owned by Hampshire Realty Trust, has been the site of petroleum and waste oil storage/handling reportedly since the 1920s. Parcel 2 (approximately 19 acres), owned by Sun Realty Trust, has been used largely for commercial sand and gravel operations. Parcel 1 is depicted as Lot 12 on Plaistow Tax Map No. 32. Parcel 2 is depicted as Lot 7 on Plaistow Tax Map No. 51. Access to Parcel 1 is currently restricted by a chain link fence which surrounds the developed portion of Parcel 1, except for a small wooded portion of its boundary with Parcel 2. Access to Parcel 2 is currently restricted by a chain link fence which partially bounds Parcel 2 and Kelly Brook, which is located near the northern boundary of the Property.

The Property has road frontage on Kelley Road and Old County Road. Parcels 1 and 2 are zoned as medium density residential property. The abutting properties and vicinity of the Site are largely residential. Non-residential properties of possible environmental significance near the Site include an auto salvage junkyard located to the north of Kelley Road and the former Plaistow municipal landfill located approximately 2,000 feet to the north of the Site.

The topography on Parcel 1 is generally flat. Notable exceptions include the depression in the central portion of the Parcel which formerly contained large fuel oil ASTs, surface water runoff pits near the entrance to Parcel 1 (SWRP 1) and near the eastern boundary of Parcel 1 (SWRP 2), and the northeastern portion of the Parcel where topography slopes towards Kelley Brook. The topography of Parcel 2 has been altered by sand and gravel mining operations in the 1950s and 1960s, and by regrading activities in the 1980s. In addition, piles of soil and debris are present on Parcels 1 and 2.

3. Site Features

Site features are depicted on attached Figure 1.3. Parcels 1 and 2 are generally unpaved, except in the vicinity of the Kelley Road entrance and the newer Site building. Much of Parcel 1 is relatively open and sparsely vegetated, with wooded areas around the perimeter of the parcel. Parcel 1 was the location of all waste storage and recycling operations. Detailed features of Parcel 1 are depicted on attached Figure 1.4. Prior EPA and DES actions have resulted in the removal of all abandoned wastes and storage containers. Currently, the only infrastructure remaining on-Site is a newer commercial building, an office trailer, and two small treatment buildings, storage tanks and piping associated with the ongoing EPA removal of LNAPL. The southeastern portion of Parcel 2 is largely open, with limited grassy and scrubby vegetation. The more northeastern portion of Parcel 2 is largely wooded, including an area of planted pines, with several unpaved access roads. Numerous soil piles are located primarily on Parcel 1.

Kelley Brook flows in an easterly direction along the northern boundary of Parcels 1 and 2. Kelley Brook originates approximately 2 miles southwest of the Site and continues to flow eastward into Little River, which continues to flow into the Merrimack River several miles downstream. Kelley Brook is not a source for drinking water.

Groundwater beneath the Site is contained in a relatively shallow sand aquifer which extends to bedrock approximately 90 feet below ground surface. The water table is located approximately 30 feet beneath the ground surface on Parcel 1 and decreases to about 1 foot below ground surface to the northen end of the property, approaching Kelley Brook. The groundwater flows from Parcel 1 to the north and east across Parcel 2, where a portion of the plume discharges to Kelley Brook. The plume flows off-Site and has impacted properties located immediately east of Parcel 2.

The Town of Plaistow does not have a municipal water supply. The shallow and bedrock aquifers beneath the Site serve to supply potable water to surrounding properties, which are primarily residential. Point of entry treatment systems have been installed by DES to provide potable water from three supply wells which contain levels of Site-related contaminants in excess of drinking water standards. One bedrock supply well, which serves an adjacent residential property on Kelley Road, is located on Parcel 1. This well does not contain any contaminants.

Three buildings are, or were formerly located at the Site. A newer commercial building (circa 1980s) is located near the Site entrance on Parcel 1. This approximately 10,000-square-foot building was formerly used as the Beede Waste Oil office building and for laboratory analyses, burner repair, used oil sludge processing and vehicle maintenance. An approximately 4,000-square foot canopied area formerly used for drum storage is located along the southwest side of this building. This building is in relatively good condition. An older commercial building was formerly located approximately 300 feet east of the newer building on Parcel 1. This approximately 7,200-square foot building was used for antifreeze recycling, vehicle maintenance and office and storage space. This older Site building was demolished in April 1998 during the course of the RI activities to allow safe access for investigation of the underlying waste materials. The third building, formerly a rented residence and now vacant, is located at the northeast end of Parcel 2 along Old County Road. This approximately 800 square foot building is in disrepair.

Other environmentally significant Site features include:

- An unlined surface lagoon formerly located in the central portion of Parcel 1 near the northeast end of the AST containment structure appears to have received releases of contaminants (e.g., waste oils). The lagoon was filled-in by the Site owner sometime in the 1970's.

- The former 140,000-gallon waste oil underground storage tank (UST) was located to the west of the former older Site building. This UST was removed by the Site owner in June 1991.

- Up to approximately 11 ASTs were formerly located immediately to the southwest of the UST (former AST storage area).

- A former drywell located between the former UST and older Site building which may have received discharges of oil/chemicals from operations in the older Site building.

- Two free product oil (free product) recovery wells constructed by the Beede Waste Oil Site owner are present to the east of the former location of the 140,000-gallon UST and older building.

- Two free product recovery trenches, constructed by the Site owner in 1992, were formerly located to the east of the older building. Approximately 15 drums of liquid waste containing chlorinated volatile organic compounds (CVOCs) and other solvents were encountered and removed by the Site owner during excavation of the trenches.

- A 120 foot long free product interceptor trench, constructed by EPA in 1997, is located along the edge of Kelley Brook, in the approximate former location of the more easterly trench.

- A buried solid waste area encompassing about 5,000 cubic feet of material and covering approximately an acre.

- Nearly 100 ASTs of various capacities, totaling approximately one and a half million gallons, were formerly located on Parcel 1 and contained waste oil and associated water and sludge. These former ASTs are designated as Tanks 1 through 87 and C1 through C5 on Figure 1.4. Active leakage of waste oil from several of these ASTs was observed during the course of EPA and DES Site investigation activities. An extensive area of stained soils surrounds the former location of many of the ASTs.

- Approximately 40 storage tanks and truck trailer tanks of various capacities, most generally empty, scattered at various above-ground locations on Parcel 1.

- Approximately 800 drums of waste material were formerly stored under the canopied area of the newer Site building. This material was generated by Beede Waste Oil Site operational activities and remedial activities conducted on and off-Site by former Site operators. The drummed wastes included soil, sludge, waste oil and contaminated protective clothing.

- A solvent distillation unit was formerly stored near the western corner of Parcel 1 to the west of the newer Site building.

- Seventeen contaminated soil and debris piles totaling approximately 24,000 tons are present on Parcels 1 and 2. Piles 1 through 13 are shown on Figure 1.4. The remaining four piles were generated during EPA removal and remedial activities and are stored on Parcel 1.

- The AST containment structure formerly contained three larger (approximately 250,000 gallons each) and five smaller (approximately 30,000 gallons each) ASTs reportedly formerly used for storage of No. 2 fuel oil, diesel and kerosene. An approximately 10,000-gallon AST for waste oil collection as well as two other smaller ASTs were also formerly located within the AST containment structure. Surface releases have been documented for this containment structure.

- Surface releases of petroleum products have been documented for both SWRPs 1 and 2.

- Several ASTs of various sizes reportedly used to store waste oil, kerosene and diesel fuel, and associated kerosene and diesel fuel pump islands were formerly located in the northern portion of Parcel 1 near the Site entrance.

- Approximately 17 USTs of varying ages and capacities used to store gasoline, No. 2 fuel oil, waste oil and "other substances" including possibly methanol, were reportedly present on Parcel 1. Eight of these were reportedly removed in 1989; however, no documentation of closure is available.

- A 12,000-gallon gasoline UST was formerly located northwest of the AST containment structure.

There are no known articles of archaeological or historical importance located at the Site.

4. Pre-Remedial Investigations

Several focused Site investigations, listed below, were conducted by DES and the Site owners prior to commencement of the remedial investigation.

PRE-RI INVESTIGATION REPORTS

Completion Date	Lead	Investigation Focus	Consultant
March 1984	Site Owner	Groundwater	Groundwater Technology, Inc. (GTI)
November 1989	Site Owner	USTs	Haley and Aldrich (H&A)
September 1991	Site Owner	LNAPL	Aries Engineering, Inc.
November 1991	Site Owner	Groundwater	Aries Engineering, Inc.
March 1992	Site Owner	Soil	Aries Engineering, Inc.
September 1993	EPA	Bulk Stored Waste	Roy F. Weston, Inc.
February 1994	NHDES	Multi-Media	Haley and Aldrich, Inc.
June 1994	NHDES	Multi-Media	Haley and Aldrich, Inc.
December 1994	EPA	LNAPL	Roy F. Weston, Inc.
January 1995	EPA	Multi-Media	NHDES
February 1995	EPA	Sediment	Camp, Dresser & McKee Federal Programs Corp.
May 1995	NHDES	Multi-media	Sanborn, Head & Associates

Completion Date	Lead	Investigation Focus	Consultant
September 1995	NHDES	Multi-media	Sanborn, Head & Associates
January 1996	NHDES	ASTs	Sanborn, Head & Associates
March 1996	NHDES	Soil Piles	Sanborn, Head & Associates
April 1996	NHDES	Surface and Groundwater	Sanborn, Head & Associates
June 1996	NHDES	Bulk Stored Oil	Sanborn, Head & Associates
August 1996	NHDES	Fish Tissue	US Fish & Wildlife Service
September 1996	NHDES	Surface and Groundwater	Sanborn, Head & Associates
January 1997	NHDES	Bulk Stored Oil	Sanborn, Head & Associates
July 1997	NHDES	Surface and Groundwater	Sanborn, Head & Associates
August 1997	EPA	Bulk Stored Oil	Roy F. Weston, Inc. OH Materials, Corp.
January 1998	NHDES	Bulk Stored Waste	Clean Harbor's, Inc. Total Waste Management
March 2000	EPA	LNAPL	Tetra Tech NUS, Corp.

In general, EPA and DES used this extensive information to focus the sampling strategy and scope of work for the remedial investigation on known or suspected areas of contamination.

5. Remedial Investigation Sampling Strategy

All potentially impacted media were investigated. Field screening techniques were used in advance of more extensive sampling and a phased approach to soil sampling was used to provide coverage of the entire property at depth, while minimizing analytical costs to the extent practicable. A brief description of the major remedial investigation activities follows.

Site Survey

As part of the remedial investigation, between October 29 and November 13, 1997, and on January 29, 1998, and on July 21 and 22, 1998, Meridian Land Services, Inc. surveyed the elevations and locations of all monitoring wells on and off the Site property, selected residential wells, well points, staff gauges, sediment and surface water sample locations, soil sample locations, test pits, and wetland delineation points. Results were referenced to the New Hampshire State Plane Coordinate System and the United States Geological Survey datum. All surveyed features were incorporated into the base map for the remedial investigation and form the basis for volume estimates in the remedial alternatives.

Potential Waste Disposal Areas

Multiple source areas were well documented from prior investigations. However, potential waste disposal areas remained which had not been characterized to determine their contribution as potential source areas. The following tasks were employed by EPA and DES to assess the nature of these areas.

- Between September 3 and 5, 1997, a soil gas survey was performed beneath the floor slab of the newer Site building. Seventeen soil gas samples were collected from a depth of about 4 feet beneath the slab. The results conclude that the soils beneath this building do not contain elevated concentrations of VOCs.

- On September 22, 1997, seven test pits were excavated from the location of the leach field for the newer Site building. The pits were excavated to a depth of about 5 to 8 feet and the soil samples were visually classified and then screened for VOCs with a PID. An aqueous sample was also collected from the septic tank. The results conclude that the leach field is not a source of VOC contamination.

- Between June and September 1997, 64 overburden monitoring wells were installed across Parcels 1 and 2, and in select areas off-Site. Three of these monitoring wells were installed in locations immediately downgradient of the newer Site building and leach field, which provide further evidence that an active VOC source is not present in these areas.

- On August 29, 1997, a pre-demolition survey of the older Site building for asbestos, lead paint, PCB-containing electrical components and other potentially hazardous materials was performed. Areas containing asbestos and lead paint were identified and subsequently abated prior to demolition of the building.

- Between April 15 and 17, 1998, the older Site building was demolished following asbestos and lead paint abatement activities.

- Between April 20 and April 24, 1998, 42 test pits were excavated from the landfill area and adjacent area under the older Site building floor slab. The pits were excavated to depths ranging from 6 to 19 feet below grade and the soil samples were visually classified and then screened for VOCs with a PID. The test pits contained a mixture of soil and solid waste, (i.e., tires, scrap metal, etc.) No hazardous source materials were found to be present in any of the test pits.

- Selected soil samples were obtained from the land fill test pits and analyzed as part of the Phase 6 soil analysis described below. In general, samples were analyzed for PCBs, VOCs, SVOCs, PAHs and 22 metals. PCB and lead contamination found to be present in deep soil samples is associated with the LNAPL plume.

Soil Characterization

Soil characterization included six phases of soil sampling and analysis. Phases 1 through 3 consisted of sampling and screening level analysis to preliminarily evaluate the nature and extent of contamination. In addition to screening level analysis, confirmatory full level analysis was completed in approximately ten percent of the samples analyzed. Each successive phase sampled soils at incrementally greater depths.

Phase 1 samples were collected from a depth of 0 to one foot below grade, Phase 2 from two to three feet and Phase 3 from 4 to 26 feet with samples collected at two foot intervals. Phases 4 and 5 were completed together to provide additional samples for full level analysis based on results from Phases 1 through 3. Most samples were collected from a depth of one foot to three feet below grade with a few deeper samples. Phase 6 addressed soils from the soil piles, landfill area and the former older building area.

- Phase 1 - Between October 27 and November 3, 1997, about 140 soil samples were collected from zero to one foot below grade. Most samples were screened for VOCs, PAHs, TPH, PCBs and four target metals. A subset of sixteen samples (about 10%) were fully analyzed at various external laboratories for the above targets plus an additional eighteen metals, SVOCs and pesticides.

- Phase 2 - Between December 5 and December 17, 1997[2], about 35 soil samples were collected over two foot intervals from depths which were typically between two and five feet below grade. One sample was collected from a depth of about 11 to 13 feet below grade. Most samples were screened for VOCs, PAHs, TPH, PCBs and four target metals. A subset of three samples (about 10%) were fully analyzed at various external laboratories for the above targets plus an additional eighteen metals, SVOCs and pesticides.

- Phase 3 - Between December 11, 1997 and January 15, 1998, about 50 soil samples were collected over two foot intervals from depths which ranged from four to twenty-four feet below grade. Most samples were screened for VOCs, PAHs, TPH, PCBs and four target metals. A subset of five samples (about 10%) were fully analyzed at various external laboratories for the above targets plus an additional eighteen metals, SVOCs and pesticides.

- Phases 4 and 5 - On May 20 and May 21, 1998, about 25 soil samples were collected from zero to one foot below grade. An additional four samples were collected over various intervals from depths which ranged from six to twenty-four feet below grade. 18 of the 31 samples were fully analyzed at various external laboratories for VOCs,

[2]One additional sample was collected and screened on January 19, 1998.

SVOCs, PAHs, TPH, PCBs (total), pesticides and 14 target metals. Five of the 31 samples were fully analyzed for the above targets plus dioxin, except that PCB congeners/homologs were analyzed rather than total PCBs. Four of the 31 samples were analyzed for PCB aroclors only. Three of the 31 samples were analyzed for PCB congeners/homologs only. One of the 31 samples was analyzed for PCB congeners/homologs and dioxin only.

- Phase 6 - Between April 2 and April 24, 1998, about 60 soil samples were collected from the soil piles at depths ranging from 1.5 to 14 feet beneath the top depending on pile size. All samples were screened for PCBs and then fully analyzed for VOCs, SVOCs, PAHs, TPH, pesticides and 22 metals. 13 of the 57 samples were also fully analyzed for PCB congeners/homologs based on PCB screening results. Between April 21 and April 24, 1998, 14 samples were collected from test pits dug in the solid waste disposal area. 12 of the 14 samples were screened for PCBs and then fully analyzed for VOCs, SVOCs, PAHs, TPH, pesticides and 22 metals. Four of the 14 samples were also fully analyzed for PCB congeners/homologs based on PCB screening results. One of the 14 samples was also fully analyzed for total cyanide. One of the 14 samples was screened for ethylene glycol only. One of the 14 samples was screened for 22 target metals only.

- On August 25 and 26, 1999, 22 soil samples (19 surficial and three from piles) were collected and analyzed for total and TCLP lead. A subset were also analyzed for total and TCLP mercury, total and TCLP barium, total and TCLP cadmium, total and TCLP chromium, reactive cyanide and/or reactive sulfide.

Surface Water and Sediment Characterization

Degradation of surface water and sediment quality in portions of Kelley Brook were obvious from prior investigations. The remedial investigation focused on assessing the overall integrity of the Kelley Brook wetland system and identifying all potential on and off-Site sources of contamination.

- On July 18, 1997, temperature profiling was performed along Kelley Brook. Temperature and conductivity were measured at 118 points from the intersection of the brook and Kelley Road to the intersection of the brook and Route 125. The results were used to determine appropriate locations for well points and future sampling efforts.

- On September 10 and 11, 1997, 14 staff gauges were established along Kelley Brook to determine surface water elevations.

- Between October 2 and October 9, 1997, a total of 11 surface water and 20 sediment samples were collected from the brook channel. Surface water samples were analyzed for VOCs, SVOCs, PAHs, TPH, PCB congeners/homologs and 22 target metals.

Sediment samples were analyzed for VOCs, SVOCs, PAHs, TPH, TOC, PCB congeners/homologs and 22 target metals.

- On November 6 and 7, 1997, the limits of the wetland associated with Kelley Brook were determined and marked in the field. A wetland delineation report is included as Appendix F to the RI Report.

- On May 28 and 29, 1998, a total of seven additional sediment samples were collected and analyzed for VOCs, SVOCs, PAHs, TPH, PCB aroclors and 17 target metals.

- Between October 1 and October 7, 1999, woody and herbaceous plant tissue, sediment, seed germination (soil), and benthic invertebrate samples were collected from Kelley Brook. These samples were collected from an area of vegetation "die back" and submitted for chemical analysis and germination study. The plant tissue samples were analyzed for SVOCs, PAHs, PCB aroclors, herbicides and 22 target metals. The sediment samples were analyzed for the same parameters and TPH.

Overburden Groundwater Characterization

Multiple limited studies had been performed by various consultants prior to the remedial investigation. Existing monitoring wells and supply wells were considered in determining the need for additional monitoring points. A number of existing monitoring wells were re-constituted and sampled as part of the remedial investigation.

- Between June and September 1997, 64 overburden test borings were completed with 35 shallow, 15 intermediate and 14 deep monitoring wells installed. Soil samples were classified visually and screened in the field for VOCs using a PID.

- On March 24, June 12, July 10 and July 14, 1997, seven additional overburden test borings were completed with six shallow and one intermediate monitoring well.

- Between September 15 and 25, 1997, 11 well points were installed along Kelley Brook at depths from 10 to 15 below ground surface.

- Between September 17 and October 17, 1997, groundwater samples were collected using low-flow techniques from two inactive residential supply wells, 29 previously installed monitoring wells, 64 newly installed monitoring wells and the 11 well points. The samples were screened in the field for temperature, specific conductance, dissolve oxygen, pH, oxidation-reduction potential and turbidity. All 106 samples were then analyzed for VOCs at an external lab. In addition, 10 of the samples were also analyzed for SVOCs, PAHs, TPH, PCB congeners/homologs, pesticides and 22 target metals. About half of the 106 samples were also analyzed for water quality parameters including alkalinity, chloride, hardness, nitrate, orthophosphate, sulfate and TKN. Four of the samples were analyzed for ethylene glycol.

- Between March 27 and 30, 1998, free product oil (LNAPL) samples were collected from 10 monitoring wells and analyzed for PHCs, PCB aroclors, PAHs and eight target metals. The same wells were later sampled for the same water quality parameters listed in the preceding bullet.

- Between March 24 and July 14, 1998, five additional overburden test borings were completed with four shallow and one intermediate monitoring well installed. The wells were all screened for VOCs.

- Between July 15 and July 27, 1998, groundwater samples were collected using low-flow techniques from 13 monitoring wells to assess plume migration from the former distillation unit. The samples were analyzed for VOCs.

- Between September 8, 1997 and September 3, 1998, four comprehensive rounds of water level measurements were completed in monitoring wells, well points, surface water stations, and inactive supply wells.

- Annual VOC monitoring of select overburden wells (approximately 20 to 50 wells) was performed by DES in 1999, 2000, 2002 and 2003. Results have been considered in this ROD and will be consulted in the remedial design phase.

Bedrock Groundwater Characterization

Earlier studies suggested that a majority of the groundwater contamination was limited to the overburden aquifer. Contamination which extended into bedrock drinking water supply wells along the south-eastern border of the Site were likely the result of induced flow from the overburden plume. The scope of the bedrock groundwater characterization was based on this assumption.

- Between October 27 and 31, 1997, the United States Geological Survey (USGS) conducted borehole geophysical logging of six residential bedrock drinking water supply wells.

- On February 17, 1998, seven bedrock outcrops surrounding the Site were observed for lithology and the strike and dip of fractures were measured.

- Between March 25 and 27, 1998, a single bedrock monitoring well was installed on-Site.

- On April 7, 1998, groundwater samples were collected from the former Site supply well and the newly installed monitoring well using low-flow techniques. The samples were screened in the field for temperature, specific conductance, dissolve oxygen, pH, oxidation-reduction potential and turbidity. The samples were then analyzed for VOCs, 16 target metals and water quality parameters at an external lab.

- On April 13, 1998, permeability testing was performed on the former Site supply well and the newly installed monitoring well.

- Between December 1997 and April 1998, pressure transducers (data loggers) were used in several shallow overburden/deep overburden well couplets and several overburden/bedrock well couplets..

- On July 7 and July 8, 1998, USGS conducted borehole logging using one or more of the above probes on the former Site supply well and the newly installed on-Site monitoring well.

Residential Well Monitoring

Since the Site is located in a highly residential area and the Town of Plaistow does not have a public water supply and distribution system, testing of residential supply wells was extensive. Two supply wells, one serving a 20 unit condominium and another serving two residences and a small business, were found to exceed drinking water standards for VOCs. Point of use treatment systems were installed on the two well heads by DES prior to the RI.

- Between September 3 and 16, 1997, 66 supply wells were sampled and analyzed for VOCs. A subset of four wells were analyzed for 22 target metals and one for mercury.

- On April 2, 1998, groundwater samples were collected from five active and two inactive supply wells and analyzed for VOCs, PCBs, PAHs, TPH and pesticides.

- Residential wells are routinely monitored by DES. Annual, semi-annual or quarterly samples are collected based on historical trends (i.e., more frequent where a history or contamination is present) and analyzed for VOCs.

- In August 1997, DES and the New Hampshire Department of Public Health Service (DPHS) collected head space air samples above a shallow dug well located in the basement of a home adjacent to Parcel 1. While the well is no longer used as a water supply, impacts to indoor air quality were of concern given the well's location in the home. Detected concentrations were concluded to be "below levels of concern for human health risk from inhalation." EPA is in the process of releasing new guidance which will be used to assess potential vapor intrusion pathways in existing and future buildings at the Site. Most existing buildings are not located above the VOC plumes.

5. Nature and Extent of Contamination

The results of the above remedial investigation activities are summarized below. In general, soil, groundwater, sediment and surface water quality have been degraded to some extent.

The overall strategy for Site characterization was a multi-media approach which focused on known or suspected areas of contamination (Parcel 1). A grid approach was used for sampling soils in less impacted areas of the Site (Parcel 2). Composite samples were collected from the various soil piles due to their large volume and heterogenous nature. A wide range of contaminant types have been detected at the Site. The principal contaminant groups include VOCs, PHCs, PCBs and metal (particularly lead.) A summary of the known source areas, impacted media, contaminants of concern (COCs), routes of migration and possible human health and ecological receptors follows. Please refer to Secion 5.0 of the RI Report for more detail.

Source Areas

Multiple source areas were observed on the Site. Some of these source areas (i.e., the 140,000 gallon UST or the ASTs) have been partially addressed by prior EPA and DES removal actions. A significant source of groundwater and deep soil contamination, the LNAPL (or floating oil) plume, is currently being addressed through the ongoing operation of a vapor extraction system being performed as a non-time critical removal action. The principal source areas listed below have not been addressed and are the subject of this record of decision.

- A former waste oil lagoon.
- A former 140,000 gallon underground storage tank (UST).
- The above ground storage tank/surface water runoff pit 1 area (SWRP 1 area.)
- Contaminated surface soils (and soil piles) over much of parcel 1, generally near ASTs.
- The landfill area.

Please refer to Figure 1.4 which shows these source areas and other key features. The following table includes the chemical characteristics, affected media, release mechanisms and volume of the principal source areas.

Principal Source Areas

Source Area Name	Waste Type (Contaminants)	Affected Medias	Release Mechanisms	Volume or Areal Extent
Waste Oil Lagoon	waste oil (PHCs, PCBs, VOCs)	soil, GW, SW and sediment	leachate	5,200 cy 32,000 sf

140,000 gallon UST	waste oil (PHCs, PCBs, VOCs)	soil, GW, SW and sediment	spill	140,000 gallons
SWRP 1	VOCs and PHCs	soil and GW	leachate	1,600 cy
Surface Soil	PHCs, PCBs, PAHs and Lead	soil and GW	leachate and wind	55,000 cy
Landfill	drums (VOCs)	soil and GW	leachate	7,800 cy 30,000 sf

Other sources including the former distillation unit area and the SWRP 2 area have deceased substantially. Potential off-Site sources were eliminated due to differing contaminants and direction of plume migration.

Contaminants of Concern (COCs) and Affected Media

Hundreds of contaminants were detected in various media at the Site, most notably volatile organic compound (VOCs), polychlorinated biphenyls (PCBs), petroleum hydrocarbon compounds (PHCs), and metals (lead in particular). Polynuclear aromatic hydrocarbons (PAHs), as well as limited occurrences of other semi-volatile organic compounds (SVOCs), pesticides and dioxins/furans[3] were also detected in Site media but typically appear to be less widely distributed, lower in concentration, and result in less potential risk. While all contaminants must be addressed, Contaminants of Concern (COCs) were selected for soil, groundwater and sediment based on screening against regulatory criteria or potential human health or ecological risks. The identification of COCs allows EPA to more effectively evaluate risk and develop appropriate remedial strategies. COCs were not identified for surface water due to the variable concentrations, upstream off-Site sources and general lack of feasibility in directly remediating surface water.

Soil COCs

COCs for soil consist of those chemicals that result in unacceptable levels of human health or ecological risk through direct contact, or those chemicals that present the potential for leaching to Site groundwater resulting in contaminant concentrations exceeding acceptable levels. Contaminants in soil are identified as COCs if risk calculations (the potential future property resident [reasonable maximum exposure - RME] scenario) indicate excess carcinogenic risk greater than 1×10^{-6} or a non-carcinogenic hazard quotient of greater than 1.0, or present an unacceptable level of risk to ecological receptors.

[3]The selection of dioxins/furans are based on toxicity equivalent concentrations (TEQ) associated with the presence of dioxin-like PCBs.

The Ecological Risk Assessment included exposure models that indicated potential risk to terrestrial receptors (songbirds and shrews) from exposure to Site contaminants via soil invertebrates in upland portions of Parcel 1. A survey performed by a wildlife biologist indicated that adverse effects, if any, would be limited to sub-populations in the immediate vicinity of Parcel 1. In order to focus the effectiveness of remediation alternatives, a risk management decision was made to focus attention only on those ecological COCs that were also selected based on human health risk or protection of groundwater. This decision is further supported by the likely future use of the Site for residential development. It is anticipated that remediation of the Site to address excess human health risks will also address COCs contributing to ecological risks.

In addition, contaminants were selected as soil COCs, if Site soil and groundwater data and Site-specific modeling of contaminant transport and fate indicated soil concentrations resulted in unacceptable levels of contaminants present in Site groundwater. In general, contaminants selected as soil COCs based on this leaching to groundwater pathway are limited to volatile organic compounds (VOCs), as VOCs were the predominant contaminants identified in groundwater at concentrations exceeding Maximum Contaminant Levels (MCLs) or New Hampshire Ambient Groundwater Quality Standards (AGQSs).

The following table lists the 17 COCs for soil, the maximum concentration, the frequency of detection and identifies the reason for selection.

Contaminants of Concern (COCs) for Soil

COCs	Maximum Detect (mg/kg)	Frequency of Detect	Human Health Risk (dermal/ingestion)	Ecological Risk (uptake/food chain)	Exceeds MCLs/AGQSs (leaching)
Metals					
Arsenic	220	114/114	X	X	X
Chromium[4]	530	114/114	X	X	
Lead	20,000	113/114	X	X	
Mercury	24	95/114	X	X	
Nickel	920	114/114	X	X	
VOCs					

[4]Based on the conservative assumption that total chromium is present in the more toxic hexavalent form only.

Alkylbenzenes[5]	n/a	n/a			X
Benzene	0.52	3/114			X
cis 1,2 DCE	11	8/114		X	X
Ethylbenzene	33	14/114			X
Naphthalene	35	26/113		X	X
PCE	2.3	13/114		X	X
1,1,1 TCA	32	8/114			X
TCE	8.7	3/114			X
Other Organic Compounds					
TPH (C11-C22 aromatics)	8,200	101/114	X	X	
Benzo(a)pyrene	2	77/114	X	X	
Bis(2-ethylhexyl)phthalate	130	90/113	X	X	
PCBs	680	26/26	X	X	

Groundwater COCs

Contaminants in groundwater were identified as COCs if risk calculations (the potential future property resident RME scenario) indicate excess carcinogenic risk greater than 1 x 10^{-6} or a non-carcinogenic hazard quotient of greater than 1.0, or contaminant concentrations exceed chemical specific ARARs (i.e., MCLs or AGQSs).

The following table lists the 22 COCs for groundwater, the maximum concentration, the frequency of detection and identifies the reason for selection.

Contaminants of Concern (COCs) for Groundwater

COCs	Maximum Detect (ppb)	Frequency of Detect	Human Health Risk (ingestion)	Exceeds Federal MCL	Exceeds State AGQS
Metals					
Antimony	7	1/97	X	X	X
Arsenic	28	10/97	X	X	X

[5]Represents a group of seven chemicals as defined by the NHDES Risk Characterization and Management Policy. Group concentrations and frequencies of detection are not available.

Cadmium	8	2/97	X	X	X
Chromium	68	7/97	X		
Manganese	6,400	18/20	X	X	
VOCs					
n-butylbenzene*	5	2/128			X
sec-butylbenzene*	15	13/128			X
tert-butylbenzene*	0	0/128			X
p-4-isopropyltoluene*	15	11/128			X
n-propylbenzene*	43	19/129			X
1,2,4-trimethylbenzene*	460	25/129			X
1,3,5-trimethylbenzene*	200	18/129			X
Benzene	240	23/129	X	X	X
1,1 DCA	1,100	35/129			X
1,2 DCA	18	8/129	X	X	X
1,1 DCE	12	4/129	X	X	X
cis-1,2 DCE	2,500	39/118	X	X	X
Ethylbenzene	940	17/129	X	X	X
Methylene Chloride	1,900	11/129	X	X	X
Naphthalene	210	23/129	X		X
1,1,2,2 PCA	1.9	1/129	X		X
PCE	25	29/129	X	X	X
1,1,1 TCA	630	38/129	X	X	X
TCE	880	31/122	X	X	X
Vinyl Chloride	730	14/129	X	X	X

Other Organic Compounds					
TPH (C9-C10 aromatics)	n/a	n/a	X		
TPH (C11-C22 aromatics)	n/a	n/a	X		

* Risks posed by this group of 7 alkylbenzenes were evaluated as a group because of the similar chemical structures and lack of individual toxicological data. The AGQS for the group is 50 ppb.

Sediment COCs

COCs for sediment consist of those chemicals that result in unacceptable levels of human health or ecological risk and appear to be elevated above background.

The following table lists the eight COCs for sediment, the maximum concentration, the frequency of detection and identifies the reason for selection.

COCs for Sediment

COCs	**Maximum Detect (ppm)**	**Frequency of Detect**	**Exceeds Human Health Risk**	**Exceeds Ecological Risk**
Metals				
Arsenic	120	19/20	X	X
Iron	130,000	20/20		X
Lead	140	20/20		X
Manganese	12,000	20/20	X	X
Molybdenum	17	20/20		X
Other Organic Compounds				
PAHs	(naphthalene) 0.76	10/17		X
	2-(methylnaphthalene) 0.16	7/14		
PCBs (total)	3.6	16/16	X	X

Distribution of Contaminants in Soil

Shallow soil contamination is generally associated with above ground source areas, most notably the former waste oil ASTs; however, relatively elevated levels of contaminants have been detected in surface soils over much of the developed portion of Parcel 1 and the southwestern most portion of Parcel 2. The principal contaminants detected in these surface and immediately underlying shallow soils include PCBs, PHCs and lead. Generally less significant concentrations of VOCs, SVOCs (including PAHs), pesticides, dioxins/furans and metals, other than lead, were also detected.

- PCB concentrations as high as approximately 100 to 700 milligrams per kilogram (mg/kg) were detected in a few "hot spot" areas of surface and underlying shallow soils on Parcel 1. PCB concentrations of approximately 1 to 40 mg/kg were typical for much of the remainder of Parcel 1. Distribution of PCB contamination in surface soil is depicted in attached Figure 1.7.

- PHC concentrations of up to approximately 59,000 mg/kg were detected in surface soils. PHC concentrations above 10,000 mg/kg were detected in many of the surface soil samples from the former waste oil AST and SWRP 1 areas. Distribution of PHC contamination in surface soil is depicted in Figure 22 of the RI Report.

- Lead concentrations of up to approximately 20,000 mg/kg were detected in surface soils from the former waste oil AST area. Lead concentrations above 400 mg/kg are relatively common in surface soils from the developed portion of Parcel 1. Distribution of lead contamination in surface soil is depicted in attached Figure 1.9.

Deeper soil contamination is generally associated with the principal deeper contaminant source areas (i.e., the lagoon, UST/AST/SWRP 2 [including the landfill] and SWRP 1 areas) and the smear zones associated with the LNAPL downgradient of these sources. At these principal contaminant source areas, contamination was typically observed at depths of approximately 5 feet below ground surface to the bottom of the water table smear zone (typically 20 to 30 feet below ground surface). The principal contaminants detected in deep soils appear to be VOCs and PHCs, and to a lesser extent PCBs and lead. Generally less significant concentrations of semi-volatile organic compounds (SVOCs) (including PAHs), pesticides and metals other than lead were also detected. Aromatic volatile organic compounds (AVOCs) were generally the most abundant and widespread VOCs.

- PHC concentrations of up to approximately 50,000 mg/kg were detected in deeper soils with the highest concentrations observed in the lagoon and UST areas.

- PCB concentrations in contaminated deeper soils typically ranged from 1 to 5 mg/kg in the lagoon and UST areas. PCB concentrations detected in deeper soils from the landfill area were variable and ranged as high as approximately 50 mg/kg.

- Lead concentrations as high as 400 to 1,100 mg/kg were detected in deeper soils from the vicinity of the lagoon, UST and landfill areas. Lead concentrations detected in deeper soils in the SWRP 1 area ranged from 4 to 8 mg/kg.

Soil samples collected from the 15 above ground soil piles located at the Site, totaling approximately 40,000 tons of stockpiled soil, indicate the principal contaminants in the soil piles are PCBs and several of the metals including lead, mercury and zinc; and to a lesser extent the SVOCs including the intermediate to heavy PAHs and bis(2-ethylhexyl)phthalate.

Distribution of Contaminants in Groundwater

VOCs are the principal contaminants detected in groundwater. Metals, SVOCs, PHCs and PCBs were generally detected at relatively low concentrations (i.e., below relevant MCLs), or not detected.

Overall, VOC groundwater contamination extends generally northeast to east over 2,000 feet from source areas on Parcel 1, to Kelley Brook and downgradient water supply wells and monitoring wells located south of Parcel 2. Total target VOC concentrations as high as approximately 7,500 micrograms per liter (µg/l) were detected in Site groundwater. The highest VOC concentrations (i.e., over 1,000 µg/l total VOCs) generally were detected in groundwater samples collected from the vicinity and near downgradient of the lagoon and UST/AST/SWRP 2 free product areas, and the immediate vicinity of the distillation unit area. Somewhat lower VOC concentrations were detected in the SWRP 1 area. AVOCs and CVOCs are dominant in the lagoon and UST/AST/SWRP 2 areas and downgradient. In general, only AVOCs were detected in the SWRP 1 area and CVOCs in the distillation unit area.

VOCs detected in groundwater at concentrations exceeding MCLs and/or AGQSs include: benzene, alkylbenzenes, ethylbenzene, naphthalene, 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), 1,1-dichloroethene (1,1-DCE), cis-1,2-DCE, methylene chloride, PCE, 1,1,1-trichloroethane (TCA), TCE and vinyl chloride (VC).

Several pesticides including, dieldrin, alpha-BHC, beta-BHC, gamma-BHC and aldrin were detected in groundwater from monitoring wells located on Parcels 1 and/or 2 at concentrations exceeding AGQSs. Reported pesticide concentrations appear to be artificially high due to the presence of PHCs. Low concentrations of pesticides as well as PAHs and PCBs were detected in one or more groundwater samples collected from the supply wells located to the south of Parcel 2; the detected concentrations of these contaminants were at least 1 to 2 orders of magnitude below MCLs and AGQSs.

Distribution of contaminants in groundwater are shown in attached Figure 1.14.

Distribution of Contaminants in Surface Water and Sediment

Contaminants detected in surface water and sediment include: VOCs, SVOCs (including PAHs), PHCs, PCBs, pesticides and metals. Concentrations were screened against risk threshold screening levels (RTSLs) which include EPA's Water Quality Criteria and Great Lakes Water Quality Initiative Tier II Levels for surface water, and NOAA effects-range low (ERLs) and Ontario Ministry of the Environment and Energy Lowest Effect Levels (LELs) for sediment.

The two primary areas along Kelley Brook where these VOCs were detected are near the oil breakout area (UST/AST/SWRP 2) and farther downstream to the south of Parcel 2. MTBE was detected at its highest concentrations in surface water and sediment samples from the vicinity of SWRP 1, with concentrations decreasing downstream. None of the detected VOC concentrations exceed referenced RTSLs. Naphthalene was the only VOC detected at concentrations in sediment which exceeded RTSLs.

PAHs are the predominant SVOCs detected in surface water and sediment samples. The highest concentrations of PAHs, largely intermediate to heavy PAHs, were detected in samples collected from the vicinity of SWRP 1. Typically, samples collected from farther downstream along Kelley Brook exhibited lower concentrations of PAHs (also lower than background sample concentrations) with the same general pattern of predominance of intermediate to heavy PAHs. However, samples collected in two reaches from along Kelley Brook, near the oil breakout area and in the downstream portion of Kelley Brook to the south of Parcel 2 exhibited relatively elevated concentrations of the lightest PAHs (naphthalene and/or methylnaphthalene). Only benzo(a)pyrene was detected at concentrations in surface water which exceeded RTSLs. Many of the PAH concentrations, particularly for naphthalene, 1-methylnaphthalene and 2-methylnaphthalene, in sediment exceeded RTSLs.

The highest concentration of PHCs (approximately 15,000 mg/kg) was detected in the sediment sample from the immediate vicinity of the oil discharge area. Typically the remaining sediment samples exhibited PHC concentrations in the range of approximately 20 to 400 mg/kg. PHCs were either not detected or detected at low concentrations in surface water samples. There are no RTSLs for PHCs in sediment.

The highest concentrations of PCBs (up to 3.6 mg/kg) were detected in sediment samples collected in the immediate vicinity of the oil discharge area. PCB concentrations in sediment were generally lower downstream of this area (approximately 0.02 to 0.7 mg/kg). Most PCB concentrations in sediment exceeded RTSLs. No PCBs were detected in surface water samples.

Metals were found in surface water and sediment samples throughout Kelley Brook. In general, detected metals concentrations in non-background samples infrequently exceed the concentrations detected in background samples. The concentrations of metals detected in the vicinity of the oil breakout area are generally highest in both surface water and sediment. Elevated concentrations of many metals in surface water were detected in sample SW-1, which is considered a background sample since it is located well upstream of the Site. Concentrations of barium, iron, lead and manganese exceeded RTSLs in non-background and background surface water samples. Concentrations of arsenic, barium, iron, lead, manganese, mercury, molybdenum and thallium exceed RTSLs in sediment and were most elevated in samples collected from the oil breakout area.

Sample locations in sediment and surface water are shown in Figure 46 of the RI Report.

Potential Routes of Migration

The principal mechanisms for subsurface transport of contaminants are identified as migration of free product LNAPL and dissolved phase migration with groundwater. Available data indicate only relatively limited dense non-aqueous phase liquid (DNAPL) mass was present at the distillation unit area and no evidence of mobile free product DNAPL has been observed throughout the remainder of the Site. Recent data indicates that the distillation unit area plume has attenuated.

The LNAPL plumes have co-mingled and are contaminated with PHCs, PCBs, lead and, to a lesser extent, AVOCs, CVOCs and PAHs. These chemicals migrate with the free-product LNAPL and some (AVOCs and CVOCs) are transferred through chemical breakdown into groundwater as dissolved constituents. A portion of the free-product LNAPL also discharged to Kelley Brook prior to EPA's installation of an interceptor trench.

The elevated concentrations of AVOCs, CVOCs and, to a lesser extent, lighter PAHs observed in Site groundwater indicate that migration as a dissolved constituent in groundwater is an important transport mechanism for these compounds.

There are five identified contaminated groundwater plumes at the Site;

1. the lagoon plume,
2. UST/AST/SWRP 2 plume,
3. SWRP 1 plume,
4. distillation unit plume, and
5. PCE plume.

The lagoon plume appears to be primarily responsible for the contamination of residential wells located to the south of Parcel 2. Near the source, this plume has elevated concentrations of both CVOCs and AVOCs; however, in the downgradient portions of this plume, AVOC concentrations are greatly reduced and the CVOCs are relatively highly biodegraded as evidenced by significant concentrations of VC and chloroethane. Discharge of the lagoon plume to Kelley Brook in the northeastern portion of Parcel 2 and to the south of Parcel 2 appears to be responsible for the presence of CVOCs, AVOCs and/or light PAHs in surface water and sediment along this reach of Kelley Brook and associated wetlands.

The UST/AST/SWRP 2 plume appears to discharge largely to Kelley Brook immediately to the northeast of the source area. Free-product LNAPL also discharges from this source area. The southern portion of this plume may flow across Parcel 2 potentially merging/flowing over the northernmost portion of the lagoon plume. Biodegradation also appears to be highly active in this plume with AVOC concentrations decreasing dramatically downgradient, and abundant CVOC degradation products including elevated concentrations of VC and chloroethane.

The SWRP 1 plume appears to merge and/or flow under the northern portion of the UST/AST/SWRP 2 plume. This plume is characterized by a typical absence of CVOCs. This plume appears to discharge to Kelley Brook in the general vicinity and upstream of the oil discharge area, and the impact of this plume on surface water and sediment quality is relatively minor compared to the impact of free product and groundwater discharge from the UST/AST/SWRP 2 area.

The distillation unit area plume was distinct both spatially and chemically from other plumes identified at the Site. The CVOCs were dominated by methylene chloride and TCE with no apparent biodegradation products or AVOCs. The apparent absence of biodegradation was attributed to the presence of CVOCs as the sole contaminants and the oxygenated state of the groundwater. This plume was also distinct in that it was relatively young (initiated in approximately 1993/1994), and never reached a surface water discharge zone (Kelley Brook). Recent (post RI) data suggests that the distillation unit area plume has fully attenuated.

The PCE plume appears to flow over and/or merge with the southern portion of the apparently much larger and higher concentration lagoon plume. Further, this plume appears to have a relatively broad and diffuse source area, which is less well defined and not as clearly evident as the source areas for the other plumes. Hence, this plume is commonly difficult to distinguish from the lagoon plume. PCE is typically the predominant or only CVOC detected. AVOCs are generally absent from this plume. The generally limited extent of biodegradation in this plume is attributed to the same factors as is given for the solvent distillation unit plume.

There also appear to be off-Site sources of contaminants to Kelley Brook surface water and sediment, including off-Site source(s) of MTBE likely associated with one or more automobile salvage yards, and background sources of intermediate to heavy PAHs and many of the metals. Lower level background concentrations of PHCs, PCBs and pesticides are also evident. Off-Site groundwater sources do not appear to be interacting with on-Site plumes. Background and upstream sources of contamination were considered in determining appropriate cleanup goals. These off-site sources generally contain distinctly different chemical composition and have co-mingled with the more dominate Site-related contaminants present in surface water and sediment.

Potential Routes of Exposure

Six potential routes of human exposure were considered in the baseline human health risk assessment. These scenarios include: a future Site resident, a current resident living adjacent to the Site, a child playing in Kelley Brook, a trespasser, an adult fishing in Kelley Brook, and a future outdoor construction worker. The exposure pathways identified for these various scenarios are described further below.

- Future Site resident:
  - Dermal contact with, ingestion and inhalation (i.e., vapors) of groundwater;
  - Dermal contact with, ingestion and inhalation (i.e., dust and vapors) of soil; and
  - Ingestion of home garden produce that takes up soil contaminants.

- Current resident living adjacent to the Site:
  - Dermal contact with, ingestion and inhalation of groundwater; and
  - Inhalation of soil (fugitive dust) from the Site.

- Child playing in Kelley Brook:
  - Dermal contact with, and ingestion of surface water; and
  - Dermal contact with, and ingestion of sediment.

- Trespasser:
  - Dermal contact with, ingestion and inhalation of soil.

- Adult fishing in Kelley Brook:
  - Dermal contact with, and ingestion of surface water;
  - Dermal contact with, and ingestion of sediment; and
  - Fish consumption.

- Future outdoor construction worker:
  - Dermal contact with, ingestion and inhalation of groundwater;
  - Dermal contact with, ingestion and inhalation of soil.

Assessment endpoints selected for the baseline ecological risk assessment include:

- Wetland community structure and habitat value to wildlife species;
- Survival, growth, and reproduction of the local fishery;
- Survival and reproduction of piscivorus birds;
- Survival and reproduction of semi-aquatic mammals;
- Survival and reproduction of terrestrial wildlife; and
- Health and maintenance of the wetland vegetative community.

Representative fish species selected are Redfin Pickerel and Brook Trout. Representative mammal species selected are Short-Tailed Shrew and Mink. Selected bird species include

American Robin and Belted Kingfisher. Other selected ecological receptors include the general categories of wetland plants and benthic invertebrates.

Human health and ecological risks associated with these pathways are presented later is this document.

6. Principal and Low-Level Threats

Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or groundwater, low leachability contaminants or low toxicity source material.

Principal Threats	**Medium**	**Contaminant(s)**	**Receptor(s)**
Direct contact	Shallow soil (0 to 10 ft)	PCBs/Lead	current/future resident, trespasser, future worker, ecological
Ingestion, Highly mobile through leaching	Deep soil (> than 10 ft)	VOCs	current/future resident and ecological
Ingestion, Highly mobile	Groundwater	VOCs	current/future resident and ecological
Low-Level Threats	**Medium**	**Contaminant(s)**	**Receptor(s)**
Direct contact	Sediment	PCBs/PAHs	trespasser/wader, fisher person, ecological
Ecological (food chain)	Surface water	VOCs/PAHs	trespasser/wader, fisher person, ecological.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

1. Land Uses

The Site is currently unoccupied and has been the location of petroleum and waste oil storage/handling since the 1920s. The abutting properties in vicinity of the Site are largely single and multi-family residential.

Radius	Estimated Population[6]
Within 200 feet of Property boundary	63 residences
1 mile	2,300 people
2 miles	5,950 people
3 miles	11,800 people

In early 1997, the Town of Plaistow passed a zoning ordinance changing the two parcels which comprise the Site to medium density residential. For purposes of evaluating potential future human health risks, EPA determined that residential development was the appropriate reasonably anticipated future-use of the Site based on the following factors;

- Site is zoned as medium density residential (MDR-20),
- Discussions with local government officials and community members (abutters) supported residential use,
- Existing abutting properties, which surround the Site, consist primarily of single and multi-family residential structures, and
- Groundwater is used as an active source of drinking water.

These land-use assumptions did not change throughout the RI/FS although following release of the Proposed Plan in June 2002, the Town applied for a Reuse Grant through EPA's pilot program to fully explore future land use options. EPA awarded a $99,000 reuse grant to the Town in September 2002, following release of the Proposed Plan. The stated objectives of the grant were to;

- Determine allowable Site uses,
- Solicit public involvement,
- Identify community needs,
- Evaluate Site restrictions,
- Prioritize recommended uses, and
- Achieve support for a reuse plan.

[6]Remedial Investigation Report, 2001

To achieve these stated goals, the Town formed a steering committee to oversee the reuse grant process. Committee members include the Town Manager, two members of the Planning Board, two members of the Board of Selectmen, the Fire Chief, and two abutters to the Site. EPA and DES attended committee meetings to answer questions about the Site. The committee met approximately once a month throughout the reuse planning process. The committee developed an extensive outreach effort designed to educate and build consensus among stakeholders. Outreach efforts identified by the Town included distributing surveys and holding a series of public meetings which extended into mid-2003. These efforts culminated in the adoption of a Reuse Plan by the Town Board of Selectmen in May 2003 which identifies mixed residential and recreational uses for the Site.

EPA considered the results of the Town's reuse planning process in further evaluating land use assumptions for this ROD. EPA believes that the reasonably anticipated future use of the Site remains residential and that the entire Site should be cleaned up to standards that would allow for safe and unrestricted residential use. This decision takes into account the aforementioned assumptions, the Town's reuse plan, comments received during the Proposed Plan comment period and the following additional factors;

- The Town has indicated that it does *not* intend to foreclose on the Site properties for non payment of property taxes at this time and it is expected that the Site zoning will remain residential.

- The groundwater aquifer beneath the Site is an active source of drinking water for area users and has been classified as a "High Use and Value" aquifer by DES.

- The Town's reuse plans include residential and recreational uses for the two parcels which comprise the Site. Given the conceptual nature of the Town's reuse plans, it is uncertain where specific housing will be placed on Parcel 1. EPA must assume that residential dwellings could be placed anywhere on Parcel 1.

- Site access was determined to present a significant limitation to potential future uses. Current access to the entire 40 acre Site is from one access point on Parcel 1, from Kelley Road, which is a narrow residential roadway. Parcel 2 does not provide direct access and all access is through Parcel 1. The limited access minimizes the type of peak flow which organized events on recreational fields could generate. The current access is adequate for the level of residential use currently proposed by the Town on Parcel 1.

Please refer to the Reuse and Redevelopment Report (March 2003), developed by the Town of Plaistow, and the Responsiveness Summary included as Part 3 to this ROD, for more detail.

2. Groundwater Uses

The Town of Plaistow does not have a municipal water supply and distribution system anywhere within the Town. All residences and commercial facilities obtain their water from private or shared water supply wells. Consequently, the DES has issued a "High Use and Value" classification for area groundwater (their highest quality classification).

Water supply wells located at several properties to the south of Parcel 2 and one to the north of Parcel 1 have been impacted by Site contaminants. Two residential supply wells; one which serves a twenty unit condominium and one which jointly serves two residences and a business, have been provided point-of-use treatment systems since the mid-1990's because concentrations of VOCs exceed drinking water standards. The treatment units each consist of an air stripper and carbon units and are maintained by DES on a regular basis. One bedrock supply well (WS-2) for an abutting Kelley Road resident is located on-Site. Treatment is not necessary for this well since continued sampling results confirm that contaminants are not present in this well.

The estimated population drinking from groundwater sources within four miles of the Site is summarized below:

ESTIMATED DRINKING WATER POPULATIONS SERVED BY GROUNDWATER SOURCES WITHIN FOUR MILES OF PROPERTY[7]

Radial Distance from Property (miles)	Estimated Population Served by Private Wells	Estimated Population Served by Public Wells	Total Estimated Population Served by Groundwater
0.00-<0.25	304	0	304
0.25-<0.50	953	0	953
0.50-<1.00	971	0	971
1.00-<2.00	1,890	1,830	3,720
2.00-<3.00	5,417	411	5,828
3.00-<4.00	3,550	1,027	4,577
TOTALS	12,979	3,268	16,247

3. Surface Water Uses

Kelley Brook crosses the north and northeastern portions of the Site and flows into the Little River approximately 3,000 feet to the southeast. From this confluence, the Little River flows approximately six miles in a generally southward direction and discharges into the Merrimack River at Haverhill, Massachusetts.

[7] Remedial Investigation Report, 2001.

The Little River and all its tributaries (including Kelley Brook) are designated as Class B surface water bodies by the NHDES. The Class B designation indicates the surface waters are "potentially of the second highest quality and are acceptable for swimming and other recreation, fish habitat and for use as a water supply following adequate treatment." There are no known drinking water intakes within 15 miles downstream of the Site along Kelley Brook / Little River / Merrimack River. Kelley Brook and Little River formerly received approximately 100 stocked brook trout annually, but it is no longer stocked. Both Kelley Brook and the Little River are presumed to be fished recreationally (i.e., non-subsistence). The Merrimack River is used for fishing, boating and other recreational activities.

4. Summary of Current and Future Uses

The current and future uses of the land, groundwater and surface water are summarized in the following table.

CURRENT AND FUTURE USES

	Current On-Site Use	**Current Adjacent Use**	**Anticipated On-Site Future Use**	**Basis for On-Site Future Use**
Land	none, trespasser	residential	residential, recreational	zoning, reuse plan
Shallow Groundwater	none	supply wells	supply wells	zoning, reuse plan, no public supply
Deep Groundwater	none, one supply well	supply wells	supply wells	zoning, reuse plan, no public supply
Surface Water	none	fishing, recreation	fishing, recreation	reuse plan

G. SUMMARY OF SITE RISKS

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The human health risk assessment followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the Site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below followed by a summary of the environmental risk assessment.

1. Human Health Risk Assessment

Seventy three (73) of the several hundred chemicals detected at the Site were selected for evaluation in the human health risk assessment as chemicals of potential concern (COPCs). The COPCs were selected to represent potential Site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Table 1 of the Human Health Baseline Risk Assessment Report. From the 73 COPCs, a subset of 29 chemicals were identified in the Feasibility Study Report as presenting a significant current or future risk and are referred to as the chemicals of concern (COCs). The COCs were identified by specific medium, in this case soil (17 COCs), groundwater (21 COCs) and sediment (7 COCs), and are summarized in previous tables of this ROD and in Tables 2-1, 2-5 and 2-8 of the Feasibility Study Report. Note that the total number of Site related COCs is less than the summation of media-specific COCs, since many chemicals are present in several different media.

The following tables contain summarized medium-specific exposure point concentrations used to evaluate the reasonable maximum exposure scenario (RME) in the baseline risk assessment for each of the COCs. The complete set of RME tables, along with estimates of average or central tendency exposure concentrations for each COC and all COPCs can be found in Appendix H of the Human Health Baseline Risk Assessment Report.

Surface Soil - Current and Future Use
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe/Receptor: Current Trespasser/Future Resident
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Ave	Max					
Parcels 1 and 2 Soil (0 - 1 foot) Direct Contact	Arsenic	6.3	22	mg/kg	114/114	7	mg/kg	95% UCL
	Chromium*	31	530	mg/kg	114/114	530	mg/kg	MAX
	Lead	790	20000	mg/kg	113/114	900	mg/kg	95% UCL
	Mercury	0.21	2	mg/kg	95/114	0.30	mg/kg	95% UCL

	Nickel	38	920	mg/kg	114/114	920	mg/kg	MAX
	Benzene	n/a	0.52	mg/kg	3/114	n/a		
	cis 1,2DCE	.0025	.004	mg/kg	8/114	0.004	mg/kg	MAX
	Ethylbenzene	n/a	33	mg/kg	14/114	n/a		
	Naphthalene	.25	.59	mg/kg	26/113	0.59	mg/kg	MAX
	PCE	0.72	2.3	mg/kg	13/114	2.3	mg/kg	MAX
	1,1,1 TCA		32	mg/kg	8/114	n/a		
	TCE		8.7	mg/kg	3/114	n/a		
	TPH	1000	8,200	mg/kg	101/114	8,200	mg/kg	MAX
	Benzo(a)-pyrene	0.39	2	mg/kg	77/114	2	mg/kg	MAX
	Bis(2-ethylhexyl)-phthalate	28	130	mg/kg	90/113	130	mg/kg	MAX
	Total PCBs	54	680	mg/kg	26/26	380	mg/kg	95% UCL

Key

mg/kg: Milligrams per Kilogram
95% UCL: 95% Upper Confidence Limit
MAX: Maximum Concentration

This table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in soil (*i.e.*, the concentration that will be used to estimate the exposure and risk from each COC in the soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived. The table indicates that PCBs, as well as several metals, are the most frequently detected COCs in surface soil at the Site.
* Chromium is a concern only in the hexavalent form. It is most likely in the trivalent form.

Surface and Subsurface Soil- Future Use
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe/Receptor: Future Resident
Medium: Soil
Exposure Medium: Surface and Sub-Surface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Ave	Max					

Parcel 1 and 2 Soil (0 - 10 foot Direct Contact	Arsenic	6.3	220	mg/kg	114/114	6.6	mg/kg	95% UCL
	Chromium*	26	530	mg/kg	114/114	530	mg/kg	MAX
	Lead	430	20000	mg/kg	113/114	490	mg/kg	95% UCL
	Mercury	6.1	24	mg/kg	95/114	24	mg/kg	MAX
	Nickel	23	920	mg/kg	114/114	920	mg/kg	MAX
	Alkylbenzenes	n/a	n/a			n/a		
	Benzene	n/a	0.52	mg/kg	3/114	n/a		
	cis 1,2DCE	1.9	11	mg/kg	8/114	11	mg/kg	MAX
	Ethylbenzene	n/a	33	mg/kg	14/114	n/a		
	Naphthalene	0.95	22	mg/kg	26/113	0.80	mg/kg	95% UCL
	PCE	0.35	2.3	mg/kg	13/114	0.13	mg/kg	95% UCL
	1,1,1 TCA	n/a	32	mg/kg	8/114	n/a		
	TCE	n/a	8.7	mg/kg	3/114	n/a		
	TPH	460	8,200	mg/kg	101/114	660	mg/kg	95% UCL
	Benzo(a)-pyrene	0.39	2	mg/kg	77/114	2	mg/kg	MAX
	Bis(2-ethylhexyl)-phthalate	14	130	mg/kg	90/113	34	mg/kg	95% UCL
	Total PCBs	35	680	mg/kg	26/26	98	mg/kg	95% UCL

Key

mg/kg: Milligrams per Kilogram
95% UCL: 95% Upper Confidence Limit
MAX: Maximum Concentration

This table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in soil (*i.e.*, the concentration that will be used to estimate the exposure and risk from each COC in the soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived. The table indicates that PCBs, as well as several metals, are the most frequently detected COCs in surface and sub-surface soil at the Site.
* Chromium is a concern only in the hexavalent form. It is most likely in the trivalent form.

Groundwater-Current Use
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe/Receptor: Current Resident
Medium: Groundwater
Exposure Medium: Tap Water

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Ave	Max					

Ingestion of Tap Water in Off-Site Supply Wells	Vinyl Chloride	2.1	2.1	ug/l	14/129	2.1	ug/l	MAX
	cis-1,2 Dichloroethene	20	29	ug/l	39/118	29	ug/l	MAX
	1,2 Dichloroethane	1.1	1.1	ug/l	8/129	1.1	ug/l	MAX
	Benzene	0.52	0.52	ug/l	23/129	0.52	ug/l	MAX
	1,1,1 Trichloroethane	2.6	4.1	ug/l	38/129	4.1	ug/l	MAX

Key

ug/l: Micrograms per Liter
95% UCL: 95% Upper Confidence Limit
MAX: Maximum Concentration

This table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in groundwater (*i.e.*, the concentration that will be used to estimate the exposure and risk from each COC in the groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived. The above contaminants were the most frequently detected in tap water sampled from supply wells around the Site.

Groundwater-Future Use
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe/Receptor: Future Resident
Medium: Groundwater
Exposure Medium: Tap Water

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Ave	Max					
Ingestion of Tap Water in Future On-Site Supply Wells	Antimony	7	7	ug/l	1/97	7	ug/l	MAX
	Arsenic	17	28	ug/l	10/97	28	ug/l	MAX
	Cadmium	4.5	8	ug/l	2/97	8	ug/l	MAX
	Chromium*	44	68	ug/l	7/97	68	ug/l	MAX
	Manganese	2200	6,400	ug/l	18/20	6,400	ug/l	MAX
	Alkylbenzenes	n/a	n/a			n/a		
	Benzene	48	240	ug/l	23/129	240	ug/l	MAX
	1,1 DCA	84	1,100	ug/l	35/129	1,100	ug/l	MAX
	1,2 DCA	11	18	ug/l	8/129	18	ug/l	MAX
	1,1 DCE	6.8	12	ug/l	4/129	12	ug/l	MAX
	cis-1,2DCE	360	2,500	ug/l	39/118	2,500	ug/l	MAX

	Ethylbenzene	150	940	ug/l	17/129	940	ug/l	MAX
	Methylene Chloride	240	1,900	ug/l	11/129	1,900	ug/l	MAX
	Naphthalene	71	210	ug/l	23/129	210	ug/l	MAX
	1,1,2,2PCA	1.9	1.9	ug/l	1/129	1.9	ug/l	MAX
	PCE	8.4	25	ug/l	29/129	25	ug/l	MAX
	Toluene	210	550	ug/l	17/129	550	ug/l	MAX
	1,1,1TCA	98	630	ug/l	38/129	630	ug/l	MAX
	TCE	75	880	ug/l	31/122	880	ug/l	MAX
	Vinyl Chloride	120	730	ug/l	14/129	730	ug/l	MAX
	TPH (C9-C10)	480	780	ug/l	unk	780	ug/l	MAX
	TPH (C11-C22)	150	220	ug/l	unk	220	ug/l	MAX

Key

ug/l: Micrograms per Liter
95% UCL: 95% Upper Confidence Limit
MAX: Maximum Concentration

This table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in groundwater (*i.e.*, the concentration that will be used to estimate the exposure and risk from each COC in the groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived.
* Chromium is a concern only in the hexavalent form. It is most likely in the trivalent form.

Sediment-Current Use
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe/Receptor: Current Trespasser and Fisherperson
Medium: Sediment
Exposure Medium: Kelley Brook and Adjacent Wetlands

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Ave	Max					
Kelley Brook and Adjacent Wetlands Sediment - Direct Contact	Arsenic	22	120	mg/kg	19/20	58	mg/kg	95% UCL
	Manganese	1500	12000	mg/kg	20/20	12000	mg/kg	MAX
	Total PCBs	0.77	3.6	mg/kg	16/16	3.6	mg/kg	MAX

Key

mg/kg: Milligrams per Kilogram 95% UCL: 95% Upper Confidence Limit MAX: Maximum Concentration
This table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in sediment (*i.e.*, the concentration that will be used to estimate the exposure and risk from each COC in the sediment). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived.

Potential human health effects associated with exposure to the chemicals of potential concern were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the current uses, potential future uses, and location of the Site. The Site is presently unoccupied and access is restricted by a chain link fence along the southern, eastern and western borders and Kelley Brook along the northern border. Current exposure pathways were evaluated for neighborhood children who may play in Kelley Brook, adults who may fish in Kelley Brook, trespassers who may frequent the Site and abutting residents who may consume contaminated groundwater. The reasonably anticipated future use of the Site has been determined to be residential. Therefore, future exposure pathways consider residents who may live at the Site as well as outdoor construction workers.

Six potential routes of human exposure were considered in the baseline human health risk assessment. These scenarios include: future Site resident, a current resident living adjacent to the Site, children playing in Kelley Brook, a trespasser, an adult fishing (and consuming fish) in Kelley Brook, and a future outdoor construction worker. The exposure pathways identified for these various scenarios are described further below.

1. Future Site resident:
   - Dermal contact with, ingestion and inhalation (i.e., vapors) of groundwater;
   - Dermal contact with, ingestion and inhalation (i.e., dust and vapors) of soil; and
   - Ingestion of home garden produce that takes up soil contaminants.

2. Current resident living adjacent to the Site:
   - Dermal contact with, ingestion and inhalation of groundwater; and
   - Inhalation of soil (fugitive dust) from the Site.

3. Children wading (playing) in Kelley Brook:
   - Dermal contact with, and ingestion of surface water; and
   - Dermal contact with, and ingestion of sediment.

4. Trespasser:
   - Dermal contact with, ingestion and inhalation of soil.

5. Adult fishing in Kelley Brook:
   - Dermal contact with, and ingestion of surface water;

- Dermal contact with, and ingestion of sediment; and
- Fish consumption.

6. Future outdoor construction worker:
   - Dermal contact with, ingestion and inhalation of groundwater;
   - Dermal contact with, ingestion and inhalation of soil.

A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 3.0 of the Baseline Human Health Risk Assessment.

Other pathways such as inhalation of vapors or fugitive dust were also assessed, however their contribution was considered to be relatively minor in comparison to the above-referenced pathways and therefore not presented for purposes of this discussion.[8] Please refer to Appendix J of the Baseline Human Health Risk Assessment for detailed exposure assumptions for all pathways.

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level with the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} or 1E-06 for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of Site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" - or the additional cancer risk on top of that which we all face from other causes such as second-hand smoke or exposure to ultraviolet radiation from the sun. EPA's generally acceptable risk range for Site related exposure is 10^{-4} to 10^{-6} (1E-04 to 1E-06 or 1 in 10,000 to 1 in a million). The State of New Hampshire's Department of Public Health considers exposures greater than 10^{-5} (or 1 in 100,000) to be unacceptable.

Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. A summary of the cancer toxicity data relevant to the chemicals of concern is presented in Appendix L of the Baseline Human Health Risk Assessment.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable

[8]Assessment of the vapor inhalation pathway was performed prior to release of the "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, November 2002,"

benchmark. Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in any harmful effects. RfDs are derived from epidemiological (health) or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ $\leq$ 1 (1E+00) indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI $\leq$ 1 indicates that toxic noncarcinogenic effects are unlikely. A summary of the noncarcinogenic toxicity data relevant to the chemicals of concern is presented in Appendix K of the Baseline Human Health Risk Assessment.

The following tables depict the carcinogenic/non-carcinogenic risk summary for the chemicals of concern in soil and groundwater evaluated to reflect the potential future Site resident corresponding to the reasonable maximum exposure (RME) scenario. Calculations of average or central tendency (CT) exposures are summarized in Appendix Q of the Human Health Risk Assessment report.

Future Site Resident Child/Adult

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: 1 to 6 year old Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk (Child/Adult)			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil (0 to 10 ft)	Soil On-Site-Direct Contact	Benzo (a) pyrene	7E-06/3E-06	-	3E-06/2E-06	2E-05
		Soil On-Site-Direct Contact	Dioxin TEQ*	2E-04/8E-05	-	4E-05/2E-05	3E-05
		Soil On-Site-Direct Contact	Total PCBs	8E-05/3E-05	-	3E-05/2E-05	2E-04
		Soil On-Site-Direct Contact	Arsenic	5E-06/2E-06	-	5E-073E-07	8E-06
						Soil risk total =	4E-04
Ground-Water	Aquifer	Consume Tapwater	Benzene	6E-05/7E-05	-	3E-05/7E-06	2E-04
		Consume Tapwater	1,2 DCA	2E-05/2E-05	-	3E-07/7E-07	4E-05
		Consume Tapwater	1,1 DCE	6E-05/7E-05	-	4E-06/1E-05	1E-04

		Consume Tapwater	Methylene Chloride	1E-04/1E-04	-	2E-06/5E-06	2E-04
		Consume Tapwater	1,1,2,2 PCA	3E-06/4E-06	-	1E-07/3E-07	7E-06
		Consume Tapwater	PCE	1E-05/1E-05	-	2E-05/4E-05	8E-05
		Consume Tapwater	TCE	8E-05/9E-05	-	8E-05/2E-04	3E-04
		Consume Tapwater	Vinyl Chloride	2E-02/2E-02	-	5E-04/1E-03	4E-02
		Consume Tapwater	Aldrin	7E-06/8E-06	-	5E-08/1E-07	1E-05
		Consume Tapwater	alpha-BHC	1E-06/2E-06	-	1E-06/3E-06	7E-06
		Consume Tapwater	gamma-BHC	8E-07/9E-07	-	8E-07/2E-06	4E-06
		Consume Tapwater	Dieldrin	6E-06/7E-06	-	5E-07/1E-06	1E-05
		Consume Tapwater	Heptachlor	2E-06/2E-06	-	8E-08/2E-07	4E-06
		Consume Tapwater	Heptachlor Epoxide	2E-06/2E-06	-	8E-082E-07	4E-06
		Consume Tapwater	Arsenic	3E-04/4E-04	-	2E-06/4E-06	7E-04
Groundwater risk total =							4E-02
Total Risk =							4E-02**

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's exposure to soil and ground water, as well as the toxicity of the COCs.
* Dioxin total equivalent (TEQ) risks are attributable to 2,3,4,7,8 PeCDF and dioxin-like PCBs.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

Future Site Resident Child

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total

Soil	Surface and Subsurface Soil (0 to 10ft)	Soil On-Site-Direct Contact	Total PCBs	Immune System	3E+01	-	1E+01	4E+01
			Chromium VI	No Observed Effect	1E+00	-	3E+00	4E+00
			Mercury*	Central Nervous	1E+00	-	0	1E+00
			Nickel*	Decreased Body Weight	3E-01	-	0	3E-01
Soil Hazard Index Total =								5E+01
Ground Water	Aquifer	Consume Tapwater	Benzene	Hematolog ic	2E+01	-	1E+01	3E+01
			1,1 DCA	Liver	1E+00	-	4E-02	1E+00
			1,2 cis-DCE	Liver	2E+01	-	1E+00	3E+01
			Ethylbenzene	Liver, Kidney	9E-01	-	4E+00	5E+00
			Methylene Chloride	Liver	3E+00	-	6E-02	3E+00
			Toluene	Liver, Kidney	3E-01	-	1E+00	1E+00
			1,1,1 TCA	Central Nervous	3E+00	-	6E-02	3E+00
			Vinyl Chloride	Liver	1E+01	-	5E-01	1E+01
			C9-C10 Aromatics	Decreased Body Weight	2E+00	-	6E-01	2E+00
			C11-C22 Aromatics	Decreased Body Weight	7E-01	-	4E+00	5E+00
			Naphthalene	Decreased Body Weight	1E+00	-	3E-01	1E+00
			Antimony	Blood, cholesterol	2E+00	-	8E-02	2E+00
			Arsenic	Skin, Circulatory	9E+00	-	4E-02	9E+00
			Cadmium	Kidney	2E+00	-	1E-01	2E+00
			Chromium VI	No Observed Effect	2E+00	-	2E+00	4E+00
			Manganese*	Central Nervous	3E+01	-	0	3E+01

Ground-Water Hazard Index Total =	1E+02
Hazard Index Total =	200**

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.
* Dermal risks in the RI apply a dermal absorption of 190. New guidance reduces dermal absorption to 0.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

In summary, the non-cancer risks calculated for a future Site child resident from soil and groundwater results in a **HI of 200** and a lifetime cancer risk estimate for a child and adult resident from soil and groundwater of approximately **4 x 10^{-2}**. The greatest carcinogenic risk is associated with exposure to vinyl chloride via groundwater. The child non-cancer hazard is associated approximately equally with exposure to PCBs in soil and VOCs (benzene, cis-1,2-dichloroethene and vinyl chloride) in groundwater.

[Exposure Assumptions: Groundwater = 1.5 l/day for 350 days/yr for 1 to 6 year olds; 2.0 l/day for 350 days for adults. Surface Soil = 100 mg/day for 110 days/yr for 12 years. Sub-Surface Soil = 200 mg/day for 160 days/yr for 6 years.]

The following table depicts the carcinogenic risk summary for the chemicals of concern in groundwater evaluated to reflect the current resident living adjacent to the Site corresponding to the reasonable maximum exposure (RME) scenario. The total Hazard Index for this exposure scenario is less than 1.0, therefore non-carcinogenic risks are not presented. Calculations of average or central tendency (CT) exposures are summarized in Appendix Q of the Human Health Risk Assessment report.

Current Adjacent Resident Child/Adult
Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: 1 to 6 year old Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk (Child/Adult)			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground-Water	Aquifer	Consume Tapwater	1,2 DCA	9E-07/8E-07	-	5E-08/2E-08	2E-06
		Consume Tapwater	TCE	4E-07/4E-07	-	9E-07/4E-07	2E-06
		Consume Tapwater	Vinyl Chloride	5E-05/4E-05	-	3E-06/1E-06	9E-05
						Groundwater risk total =	1E-04
						Total Risk =	1E-04**

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a resident's exposure to to ground water, as well as the toxicity of the COCs. Total risk include vapor inhalation pathway.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

In summary, the carcinogenic risks calculated for a current resident living adjacent to the property are due solely to exposure via groundwater. The calculated risks assume exposure to untreated groundwater from the two most highly contaminated residential supply wells. However, the groundwater from these supply wells is in fact treated using point-of-entry treatment systems (i.e., with VOC concentrations reduced to below analytical detection limits) prior to consumption. The risks calculated for the hypothetical scenario of exposure to untreated groundwater results in a lifetime cancer risk estimate of **1×10^{-4}**, with vinyl chloride being the principal contributor to cancer risk.

[Exposure Assumptions: Groundwater = 1.5 l/day for 350 days/yr for 1 to 6 year olds; 2 l/day for 350 days/yr for 24 years for adults.]

The following tables depict the carcinogenic/non-carcinogenic risk summary for the chemicals of concern in sediment and surface water evaluated to reflect a child wader corresponding to the reasonable maximum exposure (RME) scenario. Calculations of average or central tendency (CT) exposures are summarized in Appendix Q of the Human Health Risk Assessment report.

Current Wader Child

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Wader
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Kelley Brook	Direct Contact	Benzo(a) pyrene	2E-07	-	1E-04	1E-04
			Vinyl Chloride	4E-07	-	2E-06	2E-06
			Benzo(a)anthracine	2E-08	-	6E-06	6E-06
			Benzo(a)fluoranthene	2E-08	-	1E-05	1E-05
			Dibenz(ah)anthracene	3E-08	-	3E-05	3E-05

			Indeno(123-cd)pyrene	2E-08	-	2E-05	2E-05
Surface Water Risk Total =							2E-04
Sediment	Kelley Brook	Direct Contact	Total PCBs	2E-07	-	6E-06	7E-06
			Dioxin TEQ*	3E-07	-	2E-06	2E-06
			Arsenic	1E-05	-	2E-05	3E-05
Sediment Risk Total =							4E-05
Total Risk =							2E-04**

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child wader's exposure to surface water and sediment, as well as the toxicity of the COCs.
* Dioxin total equivalent (TEQ) risks are attributable to dioxin-like PCBs.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

Current Wader Child
Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Wader
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Kelley Brook	Direct Contact	Total PCBs	Immune System	1E-01	-	8E-01	1E+00
			Manganese*	Central Nervous	1E-01	-	0	1E-01
Sediment Hazard Index Total =								1E+00
Hazard Index Total =								1**

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.
* Dermal risks in the RI apply a dermal absorption of 190. New guidance reduces dermal absorption to 0.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

In summary, the non-cancer risks to a child wading or playing in Kelley Brook are estimated at a **HI of 1** and a lifetime cancer risk of **2×10^{-4}**; with non-cancer hazard associated primarily with total PCBs in sediment; and cancer risk due largely to heavy PAHs in surface water, and arsenic in sediment.

[Exposure Assumptions: Sediment = 100 mg/day for 110 days/yr for 12 years. Surface water = 0.05 l/day for 110 days/yr for 12 years.]

The following tables depict the carcinogenic/non-carcinogenic risk summary for the chemicals of concern in soil evaluated to reflect the current trespasser child corresponding to the reasonable maximum exposure (RME) scenario. Calculations of average or central tendency (CT) exposures are summarized in Appendix Q of the Human Health Risk Assessment report.

Current Trespasser Child

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Trespasser
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil (0 to 1 ft)	Soil On-Site-Direct Contact	Benzo(a) pyrene	2E-06	-	5E-07	2E-06
			Total PCBs	8E-05	-	3E-05	1E-04
			Dioxin TEQ*	3E-05	-	3E-05	6E-05
			Arsenic	1E-06	-	9E-08	1E-06
						Soil risk total =	2E-04
						Total Risk =	2E-04**

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child trespasser's exposure to soil, as well as the toxicity of the COCs.
* Dioxin total equivalent (TEQ) risks are attributable to 2,3,4,7,8 PeCDF and dioxin-like PCBs.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

Current Trespasser Child

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Trespasser
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil (0 to 1ft)	Soil On-Site-Direct Contact	Total PCBs	Immune System	1E+01	-	4E+00	2E+01
							Soil Hazard Index Total =	2E+01

Hazard Index Total =	20**
This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. **All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.	

In summary, the risks to current trespassers (young child - due solely to exposure to soil) are calculated at a **HI of 20** and a cancer risk of **2 x 10^{-4}**, with both cancer and non-cancer risks being dominated by PCBs.

[Exposure Assumptions: Soil = 100 mg/day for 110 days/yr for 12 years.]

The following tables depict the carcinogenic/non-carcinogenic risk summary for the chemicals of concern in sediment, surface water and fish tissue evaluated to reflect an adult fisher person corresponding to the reasonable maximum exposure (RME) scenario. Calculations of average or central tendency (CT) exposures are summarized in Appendix Q of the Human Health Risk Assessment report.

Current/Future Fisher Person
Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Fisher Person
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Kelley Brook	Tissue Consumption	Benzo(a) pyrene	1E-07	-	7E-05	7E-05
			Vinyl Chloride	3E-07	-	1E-06	1E-06
			Benzo(a)anthracine	1E-08	-	4E-06	4E-06
			Benzo(a)fluoranthene	1E-08	-	6E-06	6E-06
			Dibenz(ah)anthracene	2E-08	-	2E-05	2E-05
			Indeno(123-cd)pyrene	1E-08	-	1E-05	1E-05
						Surface Water Risk Total =	1E-04
Sediment	Kelley Brook	Direct Contact	Total PCBs	6E-07	-	3E-06	3E-06
			Dioxin TEQ*	2E-07	-	9E-07	1E-06

			Arsenic	7E-06	-	7E-06	1E-05
Sediment Risk Total =							2E-05
Fish Tissue	Kelley Brook	Consumption Brook Trout	Total PCBs	3E-05	-	-	3E-05
			Dioxin TEQ*	4E-05	-	-	4E-05
			Arsenic	3E-05	-	-	3E-05
Fish Tissue Risk Total =							1E-04
Total Risk =							2E-04**

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a fisher person's exposure to surface water and sediment, as well as the toxicity of the COCs.
* Dioxin total equivalent (TEQ) risks are attributable to dioxin-like PCBs.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

Current/Future Fisher Person
Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Fisher Person
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish Tissue	Kelley Brook	Direct Contact	Total PCBs	Immune System	2E+00	-	-	2E+00
Fish Tissue Hazard Index Total =								2E+00
Hazard Index Total =								2**

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

In summary, the risks to an adult fishing in Kelley Brook are estimated at a **HI of 5** and a cancer risk of **2 x 10^{-4}**; with the principal source of non-cancer hazard being PCBs from fish consumption; and the primary source of cancer risk being PAHs in surface water, and PCBs and arsenic from fish consumption.

[Exposure Assumptions: Sediment = 100 mg/day for 64 days/yr for 24 years. Surface water = 0.05 l/day for 64 days/yr for 24 years. Fish Consumption = 0.012 kg/day for 365 days/yr for 24 years.]

The following tables depict the carcinogenic/non-carcinogenic risk summary for the chemicals of concern in soil and groundwater evaluated to reflect the potential future on-Site construction worker corresponding to the reasonable maximum exposure (RME) scenario. Calculations of average or central tendency (CT) exposures are summarized in Appendix Q of the Human Health Risk Assessment report.

Future Construction Worker

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil (0 to 10 ft)	Soil On-Site-Direct Contact	Total PCBs	6E-06	-	1E-06	8E-06
			Dioxin TEQ*	1E-05	-	2E-06	1E-05
						Soil risk total =	2E-05
Ground-Water	Aquifer	Excavation Area	Benzene	3E-08	-	8E-06	8E-06
			PCE	5E-09	-	5E-06	6E-06
			Vinyl Chloride	8E-06	-	1E-04	1E-04
						Groundwater risk total =	2E-04
						Total Risk =	2E-04**

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a construction worker's exposure to soil and ground water, as well as the toxicity of the COCs.
* Dioxin total equivalent (TEQ) risks are attributable to dioxin-like PCBs.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

Future Construction Worker

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total

Soil	Surface and Subsurface Soil (0 to 10ft)	Soil On-Site-Direct Contact	Total PCBs	Immune System	1E+01	-	3E+00	2E+01
			Benzene	Hematologic	7E-02	-	2E+01	2E+01
			Ethylbenzene	Liver, Kidney	3E-03	-	8E+00	8E+00
			Manganese*	Central Nervous	5E-02	-	0	5E-02
Soil Hazard Index Total =								5E+01
Hazard Index Total =								50**

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects.
* Dermal risks in the RI apply a dermal absorption of 190. New guidance reduces dermal absorption to 0.
**All numbers are rounded to one significant figure to reflect the accuracy of hazard indices and cancer risk assessments.

In summary, the non-cancer risks to future on-Site construction workers are estimated at a **HI of 50** and a lifetime cancer risk of **2 x 10^{-4}**; with the non-cancer hazard due largely to benzene and PCBs in soil; and most of the cancer risk due to vinyl chloride in groundwater.

[Exposure Assumptions: Groundwater = 0.05 l/day for 150 days/yr for 1 year. Soil = 480 mg/day for 150 days/yr for 1 year.]

Please refer to Section 5.0 of the Baseline Human Health Risk Assessment for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern and for estimates of the central tendency risk.

2. Lead Analysis

Lead has been shown to affect every system in the body and is classified as a probable human carcinogen, however the most sensitive target organ is the nervous system in young children. EPA has not established a reference dose (RfD) for lead because it appears that some observed effects occur at such low doses as to be essentially without a threshold. Therefore, the Integrated Exposure and Uptake Biokinetic (IEUBK) model was used to evaluate the hazard potential posed by exposure of children (less than 6 months to 7 years of age as the most sensitive receptor group) to lead contaminated soil at the Site. The IEUBK model predicts blood lead concentrations in young children. The inputs for the model assumed that a future child resident could be exposed to surface soils (0 to 1 foot) and sub-surface soils (0 to 10 feet), and considered background exposure to indoor and outdoor lead dust.

The output of the model is predicted blood lead levels. The IEUBK model predicts a risk of nearly 70% that blood lead levels in young children exposed to soil at this Site will exceed 10 ppb. EPA and the Center for Disease Control (CDC) have determined that blood lead concentrations exceeding 10 ppb in children are associated with adverse health effects. EPA recommends that this risk not exceed 5%.

3. Human Health Risk Uncertainty

The non-cancer hazard and cancer risk estimates are subject to numerous uncertainties which may overestimate or underestimate risks. Overall, risks are more likely to be overestimated, rather than underestimated. The following bullets summarize the major areas of uncertainty that have been addressed. Please refer to Section 6.0 of the Baseline Human Health Risk Assessment for more detail.

- Data Quality Issues - COPC detection limits had to be elevated in soil samples with high levels of PCB and/or PHC contamination. Half the elevated detection limits were assumed. Also, VOCs in soil were screened out of the risk analysis due to infrequent detection which may have been from the higher detection limits. The risk assessment had to consider both PCB congener and aroclor data. The aroclor data is somewhat low-biased (i.e., total PCB results from aroclor analysis are generally lower than total PCB results from congener analysis for comparable samples). Pesticide data for all Site media is questionable due to analytical interference.

- Lack of Toxicity Criteria - Not all COPCs have toxicity values to quantify non-cancer hazard and cancer risk. For example, the risk associated with MTBE in groundwater could not be quantified.

- New TCE Toxicity Information - Risks associated with exposure to trichloroethene (TCE) do not incorporate recent toxicity information which indicates that TCE may be a more potent carcinogen than assumed in this assessment. This toxicity information has not been formally accepted. If applied, risks associated with exposure to TCE would be expected to increase two to four fold.

- Uncertainty in Average Daily Intake Calculations - A quantitative assessment of confidence in average daily intake estimates required development of a distribution analysis. Given the large effort required to prepare such an analysis, central tendency (CT) and reasonable maximum exposure (RME) intake calculations were used to provide a range of possible risks at the Site.

- Home Garden Exposure Pathway - Possible exposure to Site contaminants from a home garden was not quantified. Some organic compounds such as PCBs and PAHs can be taken up by plants to varying degrees.

- Vapor Intrusion Exposure Pathway - A future resident might be exposed to groundwater or soil COPCs that migrate into future homes via soil gas. This pathway will need to be further investigated before construction of any buildings on the Site.

- Uncertainty in RfDs and RfCs - Several uncertainty factors could be incorporated to address uncertainty resulting from differences in animals and humans, variability among individuals, and other sources.

- VOC Trends in Neighboring Supply Wells - VOC concentrations are increasing in some private supply wells near the Site. Close monitoring should continue for these wells to ensure that established drinking water criteria or combined risk is not exceeded.

4. Ecological Risk Assessment

A baseline ecological risk assessment was performed during the RI. Consistent with Region 1 guidance, the first step involved completion of a screening level risk assessment to identify potential receptors. The screening level risk assessment indicated that:

- There was potential ecological risk to aquatic and sediment-associated biota in Kelley Brook from VOCs, PAHs, pesticides and metals;
- There was potential risk from mercury, DDT, and its metabolites to higher level consumers, such as kingfisher and mink, from consuming Kelley Brook fish; and
- There was potential risk to terrestrial invertebrates and plants on Parcel 1 and nearby portions of Parcel 2 from VOCs, PCBs, PAHs and metals in soil.

Given evidence for these potential pathways, a baseline ecological risk assessment was performed which consisted of the following primary steps;

- Problem formulation;
- Effects assessment;
- Exposure assessment; and
- Risk Characterization.

The list of Contaminants of Concern (COCs) for the Baseline Ecological Risk Assessment consists of approximately 200 compounds including metals, VOCs, PAHs, other SVOCs, VPH, EPH, PCBs (including dioxin-like congeners) and pesticides. Assessment endpoints selected for the baseline ecological risk assessment included: wetland community structure and habitat value to wildlife species; survival, growth, and reproduction of the local fishery; survival and reproduction of piscivorous birds; survival and reproduction of semi-aquatic mammals; survival and reproduction of terrestrial wildlife; and health and maintenance of the wetland vegetative community. Selected receptor species included Red Fin Pickerel, Brook Trout, Short-Tail

Shrew, Mink, American Robin, and Belted Kingfisher; and the general categories of wetland plants and benthic invertebrates.

Section 1: Identification of Chemicals of Concern

The Baseline Ecological Risk Assessment relied on data collected from Parcel 1 surface soil, Kelley Brook sediment, Kelley Brook fish tissue and Kelley Brook plant tissue. All data was collected during the RI and adhered to EPA Region 1 data quality requirements. Tier II or tier III data validation was performed on all analytical results. Site data was considered to be of acceptable quality. With regard to Kelley Brook, data was collected and analyzed from four specific reaches:

- Reach KB-1: downstream of the Site, extending from the route 125 culvert to the confluence of Kelley Brook with the Little River;
- Reach KB-2: runs through the Beede Waste Oil Site, from the Kelley Road culvert to the route 125 culvert;
- Reach KB-3: upstream of the Site extending from the route 121A culvert to the Kelley Road culvert; and
- Reach KB-4: upstream of the Site and upstream of the route 121A culvert.

COCs were determined by media for soil and sediment. As indicated above, the list of COCs considered for the ecological risk assessment is extensive. Since the remedy as described in this ROD is being driven by human health risks, only an overview of the COCs are provided herein. Please refer to Table 2 of the Baseline Ecological Risk Assessment for a complete list of soil COCs and Table 3 for a complete list of sediment COCs.

- Soil COCs - 211 chemicals were identified based on their exceedance of screening levels, background levels or a lack of toxicity criteria. Chemical groups include VOCs, SVOCs, PHCs, PCBs, dioxins, furans, pesticides and metals. Screening levels used for comparison are the toxicological benchmarks provided by the Oak Ridge National Laboratory (ORNL.)

- Sediment COCs - 191 chemicals were identified based on their exceedance of screening levels, background levels or a lack of toxicity criteria. Chemical groups include VOCs, SVOCs, PHCs, PCBs, pesticides and metals.

Section 2: Exposure Assessment

The exposure assessment describes exposure concentrations, body burdens, or doses for the selected receptors. These concentrations/doses were either direct measurements or estimates of the quantity of COCs to which the receptors are exposed under Site-specific assumptions. Exposures were estimated as:

- Measured concentrations of COCs in the whole body of brook trout, redfin pickerel, and crayfish for comparison to residue effect levels, use in food chain models, and use in the narcosis model;

- Measured concentrations of 13 PAH compounds in sediments to apply in the Sum PAH model;

- Measured concentrations of COCs and herbicides in plant tissues;

- Measured concentrations of COCs and herbicides in sediments;

- Modeled (food-chain) doses of bioaccumulative COCs in soil to birds (kingfisher, songbirds); and

- Modeled (food-chain) doses of bioaccumulative COCs in soil to short-tailed shrew and mink.

Section 3: Ecological Effects Assessment

An area of vegetation die-back was observed along a portion of reach KB-2. Chemical data collected from sediment and surface water failed to identify a cause for vegetation stresses, therefore wetland plants themselves were analyzed. Tissue samples were extracted from loosestrife and red maples from three sites within the die-back area and compared to tissue samples from similar plant species in two off-Site reference sites. Concentrations of arsenic, iron, and thallium in Site plant tissues were found to be highly elevated (greater than 10 fold) over samples from the reference areas, however, elevated levels of these chemicals also fail to account for mortality in the die-back area. Seed germination tests were conducted on three Site sediment samples and two off-Site reference samples. None of the five samples had percent emergence or shoot length significantly different from the control sample. Therefore, no acute toxicity to the three plant species was observed in any of the samples and the test revealed no toxic effect associated with seed germination testing from sediments in the die-back area. More recent observations have shown re-generation of vegetation in the former die-back area.

Section 4: Ecological Risk Characterization

Food chain modeling indicated a potential risk to songbirds and small mammals from exposure to contaminants (notably PCBs [including dioxin-like congeners] and lead) via ingestion of soil invertebrates in the upland portions of Parcel 1 and adjacent Parcel 2. Further evaluation by a wildlife biologist indicated that the potential risk would likely be limited to any small sub-populations in the immediate vicinity of Parcel 1, and would not be likely to extend to larger populations within the Kelley Brook watershed. Based on this evaluation it is likely that contaminated soil on Parcels 1 and 2 pose a greater risk to human receptors than to ecological receptors.

Within the oil breakout area and immediately downstream, the principal Site-related COCs appear to be PCBs, arsenic, cadmium, iron, lead, manganese, mercury, molybdenum and PAHs (in particular, naphthalene and 2-methylnaphthalene). Comparison of contaminant concentrations in Kelley Brook sediments to sediment benchmark and background concentrations, indicate some potential for risk to sediment invertebrates from exposure to various COCs. Evaluation of the benthic invertebrate community indicates potentially impacted benthos in the oil breakout area and downstream in the die-back area (recent observations indicate regrowth of vegetation in the die-back zone); however, observations of the benthic communities from the two reference areas indicate potentially greater impacts in the presumed background off-Site locations. An evaluation of ecological risk upstream and downstream of the Site was performed by Lockheed Martin Environmental Services Company through the Environmental Services Assistance Team (ESAT) contract with EPA. This evaluation, which is attached in Appendix C, indicates similar risk upstream and downstream of the Site, suggesting that risks associated with sediment from the oil breakout area are elevated above background levels.

Food chain modeling indicates potential risks to shrews and songbirds from ingestion of invertebrates in wetland sediments. There appears to be little potential for Site-related risks to fish or higher trophic organisms (represented by Kingfisher and Mink) from exposure to contaminants from the Site through food chain exposures in Kelley Brook. The weight of evidence indicates a low potential risk to wetland plants from exposure to COCs detected in wetland sediments or plant tissue.

In addition to controlling on-Site sources (i.e., LNAPL, soil), the ecological risk assessment recommends the removal of most sediments in the immediate oil break-out area to concentrations consistent with adjacent background areas and monitoring of the benthic community.

5. Ecological Risk Uncertainty

Estimates of risk to ecological receptors are subject to numerous uncertainties which may overestimate or underestimate risks. The following bullets summarize the major areas of uncertainty. Please refer to Section 5.0 of the Baseline Ecological Risk Assessment for more detail.

- Fish Analysis - Effect levels are often based on experiments that used test species other than brook trout or redfin pickerel or are unavailable for some COCs.

- Invertebrates Analysis - Benchmarks such as ER-Ls, ER-Ms and LELs are derived largely from field studies that are correlative and not causative.

- Mink and Kingfisher Analysis - Selected benchmark doses are not necessarily the lowest effect level or the lowest no effect level reported in the literature. Rather, they represent chronic studies that were complete enough to represent a dose response.

- Songbird and Shrew Analysis - There is a range in literature values of factors for uptake of contaminants from soil to earthworms. There is a range in the parameters (total organic carbon and earthworm lipid content) used to calculate uptake factors for which there were no available literature values. The range in soil and sediment concentrations. The selection of benchmark dose for contaminants.

- Wetland Plants Analysis - Seed germination testing addresses only germination and not subsequent growth of seedlings. The phytotoxicity benchmarks do not provide an analysis of dose-response or relate directly to die-back. The comparison of plant tissue concentrations to reference area concentrations, especially for the herbaceous plants, suffers from the fact that the reference area plants were two large specimens. The die back area did not offer similarly large specimens.

6. Basis for Response Action

The baseline human health and ecological risk assessments revealed that current and future residents, trespassers, recreational persons and on-Site construction workers, as well as insectivorous mammals, are potentially exposed to compounds of concern in soil, groundwater and sediment via direct contact or ingestion and may present an unacceptable human health risk (e.g., cancer risk exceeds 1E-04 and HI exceeds 1.0) or unacceptable ecological risk (e.g., food chain model indicates potential risk to insectivorous mammals).

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. The remedial action will address this endangerment through active remediation of soil, overburden groundwater and sediment, and through monitoring surface water, bedrock and off-Site groundwater and, as appropriate, air.

H. REMEDIATION OBJECTIVES

Based on information relating to the types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives, and to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. These RAOs for the selected remedy, listed by media, are as follows:

1. Soil RAOs

- For protection of Human Health - Excavation of contaminated soil, to a depth of ten feet below ground surface, which exceed health-based action levels for residential use.

- For protection of Human Health - Treatment of contaminated soil deeper than ten feet to eliminate leaching of VOCs into groundwater at levels which exceed drinking water standards.

Soil PRGs Summary Table

Receptors	Target Compounds	Pathways	Current Risk	Clean-up Target	Preliminary Remediation Goals (PRGs)[9]
Trespasser, resident, and construction worker.	PCBs and other organics, lead and other metals, and VOCs.	Ingestion and direct contact.	Cancer = 3E-02	Cancer risk less than 1E-05	PCBs less than 0.5 ppm.
			HI = 200	HQ less than or equal to 1.0	Lead less than 400 ppm.

2. Groundwater RAOs

- For Protection of Human Health - Restoration of groundwater to drinking water standards, or in the absence of such standards, to health-based action levels.

- For Protection of Human Health - Containment of the contaminated groundwater plume to prevent further migration.

- For Protection of Human Health and Ecological Receptors - Reduction of contaminated groundwater discharge to Kelley Brook to prevent degradation of sediment and surface water quality.

Groundwater PRGs Summary Table

Receptors	Target Compounds	Pathways	Current Risk	Clean-up Target	Preliminary Remediation Goals (PRGs)[10]

[9]See Table 2-2 of the Feasibility Study Report for the full list of soil PRGs.

[10]See Table 2-7 of the Feasibility Study Report for the full list of groundwater PRGs.

Resident and construction worker. Songbird and shrew.	VOCs and to a lesser extent, metals.	Ingestion, direct contact and food chain.	Cancer = 2E-04	MCLs/AGQSs Cancer risk less than 1E-05	MCLs/AGQSs
			Qualitative ecological risk.	None specified.	

3. Sediment RAOs

- For Protection of Human Health - Excavation of certain contaminated sediment which exceeds health-based action levels.

- For Protection of Ecological Receptors - Excavation of certain contaminated sediment to reduce exposure to ecological receptors.

- For Protection of Ecological Receptors -Excavation of certain contaminated sediment to reduce releases of Site contaminants which contribute to the degradation of surface water quality in excess of Ambient Water Quality Criteria (AWQC.)

Sediment PRGs Summary Table

Receptors	Target Compounds	Pathways	Current Risk	Clean-up Target	Preliminary Remediation Goals (PRGs)[11]
Child wader and fishing person.	PCBs, metals and other organics.	Ingestion, direct contact, and fish consumption.	Cancer = 2E-04	Cancer risk less than 1E-05	PCBs less than 0.68 mg/kg Arsenic less than 16.6 mg/kg
			HI = 4	HQ less than or equal to 1.0	
			Qualitative ecological risk.	None specified.	

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a

[11] See Table 2-2 of the Feasibility Study Report for the full list of sediment PRGs.

requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment, which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the Site.

With respect to source control, the RI/FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing, to the degree possible, the need for long term management. This range also included alternatives that treat the principal threats posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

With respect to management of migration, the RI/FS developed a limited number of remedial alternatives that attain Site-specific remediation levels within different time frames using different technologies and/or engineering and institutional controls; and a no action alternative.

As discussed in Section 3.0 of the FS Report, soil and groundwater treatment technology options were identified, assessed and screened based on implementability, effectiveness, and cost. These technologies were combined into source control (SC) and management of migration (MOM) alternatives. Section 4.0 of the FS Report presents the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 5.0 of the FS Report.

In summary, of the 28 source control and 34 management of migration treatment technology options screened in Section 3.0 of the FS Report, 37 were retained as possible options for the cleanup of the Site. From this initial screening, remedial options were combined, and six (6) source control and four (4) management of migration alternatives were selected for detailed analysis.

J. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each source control and management of migration alternative evaluated.

1. Source Control (SC) Alternatives Analyzed

The source control (SC) alternatives analyzed for the Site included:

- SC-1: No Action
- SC-2: Limited Action
- SC-3: Hot Spot Removal and Capping of Shallow Soil and In-Situ Treatment of Deep Soil
- SC-4: Excavation and Off-Site Disposal of Shallow and Deep Soil
- SC-5: Excavation and Off-Site Disposal of Shallow Soil and In-Situ Treatment of Deep Soil
- SC-6: On-Site Treatment of Shallow and Deep Soil

Each of the six source control alternatives is summarized below. A more complete, detailed presentation of each alternative can be found in Section 4.3 of the FS Report.

SC-1 No Action

Alternative SC-1, the No Action Alternative, is intended to provide a baseline against which other alternatives can be compared, as required by the NCP. The No Action Alternative consists of quarterly Site inspections and five year reviews of Site conditions, but does not include maintenance or improvement to existing Site control measures, such as Site fencing or the soil pile tarpaulins, or implementation of institutional controls.

- Net present worth cost = **$156,912**
- Response time = 1,000+ years.
- Capital cost = $0.
- O & M cost = $7,453 (quarterly Site inspections)
- Periodic costs = $20,391 (5-year reviews)

Treatment Components	None
Containment Components	None
Institutional Control Components	None (State fishing advisory remains in effect.)

Monitoring Requirements	None
Operation and Maintenance Requirements	• Quarterly Site inspections. • Review of Site conditions and risks at five year intervals.
Key ARARs	None. Risks not addressed, however standards used as baseline screening tools.
Long-Term Reliability	n/a
Quantity of Untreated Wastes and/or Residuals	• 67,000 yds of shallow soil untreated. • 70,000 yds of deep soil (>10 ft) untreated. • 10,700 yds of landfill material untreated. • 1,100 yds of sediment untreated. • No residuals.
Estimated Time to Design and Construct	n/a
Estimated Time to Reach Remediation Goals	1,000+ years.
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	Parcel 1, and possibly Parcel 2 since it is accessed through Parcel 1, would *not* be available for reuse for 1,000+ years.

SC-2 Limited Action

Alternative SC-2, the Limited Action Alternative, consists of measures, generally institutional controls and limited containment (i.e., maintain fence and tarpaulins), to protect human health and the environment by limiting potential exposure and/or reducing the mobility of contaminants. This alternative does not involve active treatment/removal of contaminants.

- Net present worth cost = **$1,467,330**
- Response time = 1,000+ years.
- Capital cost = $99,306 (fence work and institutional controls).
- O & M cost = $73,034 (quarterly Site inspections, fence repair, tarpaulin repair)
- Periodic costs = $131,441 (tarpaulin replacement, 5-year reviews, sediment monitoring)

Treatment Components	None
Containment Components	None
Institutional Control Components	• Establishment of activity and use restrictions, such as property deed restrictions (Site owner or Town ordinance) to prevent excavation below 10 feet. • State fishing advisory remains in effect.
Monitoring Requirements	• Long-term monitoring of sediment and surface water. • Monitoring of wetland restoration activities.
Operation and Maintenance Requirements	• Annual maintenance and repair of soil pile tarpaulins, as well as replacement of soil pile tarpaulins every five years, generally concurrent with five-year reviews. • Repair of the existing fence and extension of the fence along Kelley Brook to enclose Parcels 1 and 2, as well as routine annual fence maintenance and repair. • Installation/maintenance of fencing around the area of contaminated sediment adjoining Kelley Brook. • Construction/maintenance of perimeter fencing around the on-Site landfill. • Quarterly Site inspections. • Review of Site conditions and risks at five year intervals.
Key ARARs	None. Risks not addressed, however standards used as baseline screening tools.
Long-Term Reliability	n/a
Quantity of Untreated Wastes and/or Residuals	• 67,000 yds of shallow soil untreated. • 70,000 yds of deep soil (>10 ft) untreated. • 10,700 yds of landfill material untreated. • 1,100 yds of sediment untreated. • No treatment residuals.
Estimated Time to Design and Construct	n/a
Estimated Time to Reach Remediation Goals	1,000+ years.
Use of Presumptive Remedies or Innovative Technologies	None

Expected Reuse Outcomes	Parcel 1, and possibly Parcel 2 since it is accessed through Parcel 1, would *not* be available for reuse for 1,000+ years.

SC-3 Hot Spot Removal and Capping of Shallow Soil and In-situ Treatment of Deep Soil

Alternative SC-3, the Hot Spot Removal and Capping of Shallow Soil and the In-Situ Treatment of Deep Soil Alternative, consists of measures including excavation and off-Site disposal of surface/shallow soil 'hot spots,' excavation and off-Site disposal of contaminated sediment, capping/containment of the remaining surface/shallow contaminated soil and the landfill, institutional controls and in-situ treatment of deeper contaminated soil, which is an ongoing source of groundwater contamination.

- Net present worth cost = **$17,974,026**
- Response time = 39 months.
- Capital cost = $9,250,743 (sediment removal, wetland restoration, RCRA and soil caps construction, thermally-enhanced SVE installation, institutional controls).
- O & M cost = $3,644,053 (sediment/wetland monitoring, RCRA and soil cap maintenance, SVE operation).
- Periodic costs = $918,718 (5-year reviews, demobilize SVE system).

Treatment Components	• Excavation and off-Site disposal of contaminated surface/shallow (i.e. 0-10 feet bgs) soil 'hot spots'(i.e., PCBs>50 mg/kg and/or RCRA characteristics). • Excavation and off-Site disposal of contaminated sediment (i.e., PCBs<50 mg/kg or non-RCRA) to a non-hazardous facility. • In-situ treatment (thermally-enhanced SVE) of deeper contaminated soil. • Extraction wells to provide dewatering/water table depression as needed in the vicinity of the deep soils to be treated in-situ. Wells should be installed in conjunction with planned MOM. • Construction of compensatory wetlands on Parcel 2 adjoining Kelley Brook to mitigate wetlands lost due to landfill capping. • Restoration/construction of wetlands at the location where contaminated sediment are excavated.

Containment Components	• Construction/maintenance of an impermeable composite cap over the on-Site landfill, and perimeter fencing around the cap. • Covering the remaining surface/shallow contaminated soil (i.e. includes most of the developed portion of Parcel 1 and the southwestern most portion of Parcel 2) with a two foot thick soil (permeable) cap, including excavation/grading of the soil piles beneath the cap.
Institutional Control Components	• Establishment of activity and use restrictions, such as property deed restrictions (Site owner or Town ordinance) to protect the soil cap and prevent excavation below 10 feet. • State fishing advisory remains in effect.
Monitoring Requirements	• Long-term monitoring of remaining sediment and surface water. • Monitoring of wetland restoration activities.
Operation and Maintenance Requirements	• Repair of the existing fence and extension of the fence along Kelley Brook to enclose Parcels 1 and 2, as well as routine annual fence maintenance and repair. • Quarterly Site inspections. • Review of Site conditions and risks at five year intervals.
Key ARARs	Safe Drinking Water Act, Clean Water Act and TSCA are attained.
Long-Term Reliability	• Maintenance of cap required. • VOCs permanently removed from deep soil.
Quantity of Untreated Wastes and/or Residuals	• 67,000 yds of shallow soil untreated. • 10,700 yds of landfill material untreated. • No treatment residuals.
Estimated Time to Design and Construct	15 months.
Estimated Time to Reach Remediation Goals	24 months.
Use of Presumptive Remedies or Innovative Technologies	• No presumptive remedies. • Thermally-enhanced SVE is an innovative technology.

Expected Reuse Outcomes	• Parcel 1 *not* available for planned residential use. • Parcel 2 available for residential use in 39 months. • Both parcels available for recreational use in 39 months.

SC-4 Excavation and Off-Site Disposal of Shallow and Deep Soil

Alternative SC-4, the Excavation and Off-Site Disposal Alternative, consists of measures including excavation and off-Site disposal of surface/shallow (i.e., 0-10 feet bgs) and deep soil (i.e., >10 feet bgs), excavation and off-Site disposal of landfill materials, excavation and off-Site disposal of contaminated sediment, and restoration of wetlands in the former locations of the landfill and contaminated sediments.

- Net present worth cost = **$41,530,534**
- Response time = 39 months.
- Capital cost = $41,228,937 (sediment, landfill, shallow and deep soil removal, wetland restoration).
- O & M cost = $28,727 (sediment/wetland monitoring).
- Periodic costs = $47,192 (5-year reviews).

Treatment Components	• Excavation and off-Site disposal of contaminated surface/shallow soil (0-10 feet bgs), deeper soil (> 10 feet bgs), landfill materials and sediment with as much material as possible going to a non-hazardous facility and limited quantities (e.g., with PCB concentrations $\geq$50 ppm, TCLP hazardous for lead) going to RCRA/TSCA facilities; • Extraction wells to provide dewatering/water table depression as needed in the vicinity of the deep soils to be excavated. Wells should be installed in conjunction with planned MOM. • Restoration/construction of wetlands at the location where the landfill and contaminated sediment are excavated.
Containment Components	None
Institutional Control Components	State fishing advisory remains in effect.
Monitoring Requirements	• Long-term monitoring of remaining sediment and surface water. • Monitoring of wetland restoration activities.

Operation and Maintenance Requirements	• Repair of the existing fence and extension of the fence along Kelley Brook to enclose Parcels 1 and 2, as well as routine annual fence maintenance and repair until soil remediation is complete. • Quarterly Site inspections. • Review of Site conditions and risks at five year intervals.
Key ARARs	Safe Drinking Water Act, Clean Water Act and TSCA are attained.
Long-Term Reliability	Target contaminants permanently removed.
Quantity of Untreated Wastes and/or Residuals	None
Estimated Time to Design and Construct	12 months
Estimated Time to Reach Remediation Goals	39 months
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	Both parcels available for residential use in 39 months.

SC-5 Excavation and Off-Site Disposal of Shallow Soil, and In-situ Treatment of Deep Soil

Alternative SC-5, the Excavation and Off-Site Disposal of Shallow Soil, and In-Situ Treatment of Deep Soil Alternative, consists of measures including excavation and off-Site disposal of surface/shallow soil (i.e., 0-10 feet bgs), excavation and off-Site disposal of landfill materials, excavation and off-Site disposal of contaminated sediment, restoration of wetlands in the former locations of the landfill and contaminated sediments, and in-situ treatment of deeper contaminated soil, which is an ongoing source of groundwater contamination.

- Net present worth cost = **$31,811,380**
- Response time = 51 months.
- Capital cost = $24,422,304 (sediment, landfill, shallow soil removal, wetland restoration, thermally-enhanced SVE installation).
- O & M cost = $3,510,125 (sediment/wetland monitoring, SVE operation).
- Periodic costs = $918,718 (5-year reviews, demobilize SVE system).

Treatment Components	• Excavation and off-Site disposal of contaminated surface/shallow soil (i.e., 0-10 feet bgs), landfill materials and certain sediment with as much material as possible going to a non-hazardous facility and limited quantities (e.g., with PCB concentrations $\geq$50 ppm, TCLP hazardous for lead) going to RCRA/TSCA facilities. • In-situ treatment (thermally-enhanced SVE) of deeper contaminated soil. • Extraction wells to provide dewatering/water table depression as needed in the vicinity of the deep soils to be treated in-situ. Wells should be installed in conjunction with planned MOM. • Restoration/construction of wetlands at the location where the landfill and contaminated sediment are excavated.
Containment Components	None
Institutional Control Components	• Establishment of activity and use restrictions, such as property deed restrictions (Site owner or Town ordinance) to protect the soil cap and prevent excavation below 10 feet. • State fishing advisory remains in effect.
Monitoring Requirements	• Long-term monitoring of remaining sediment and surface water. • Monitoring of wetland restoration activities.
Operation and Maintenance Requirements	• Repair of the existing fence and extension of the fence along Kelley Brook to enclose Parcels 1 and 2, as well as routine annual fence maintenance and repair until soil remediation is complete. • Quarterly Site inspections. • Review of Site conditions and risks at five year intervals.
Key ARARs	• Safe Drinking Water Act, Clean Water Act, and TSCA.
Long-Term Reliability	• Contaminants permanently removed from shallow soil/sediment/landfill. • VOCs permanently removed from deep soil.
Quantity of Untreated Wastes and/or Residuals	None
Estimated Time to Design and Construct	• 27 months.

Estimated Time to Reach Remediation Goals	• 51 months.
Use of Presumptive Remedies or Innovative Technologies	• No presumptive remedies. • Thermally-enhanced SVE is an innovative technology.
Expected Reuse Outcomes	• Both parcels available for residential use in 39 months.

SC-6 On-Site Treatment of Shallow and Deep Soil

Alternative SC-6, the On-Site Treatment Alternative, consists of two variations. Alternative SC-6A includes excavation and on-Site low temperature thermal desorption (thermal) treatment of surface/shallow soil (i.e., 0-10 feet bgs), deep soil (i.e., >10 feet bgs), sediment and the soil component of the landfill materials; solid waste from the landfill being disposed off-Site; some ‘high lead’ soil (e.g., shallow soil ‘hot spots’ and ‘hot smear zone’) potentially being disposed off-Site; and restoration of wetlands in the former locations of the landfill and contaminated sediments. Alternative SC-6B is similar to SC-6A in all aspects except that deep soil (i.e., >10 feet bgs) will be treated by in-situ SVE.

SC-6A Costs
- Net present worth cost = **$57,575,933**
- Response time = 56 months.
- Capital cost = $57,274,336 (sediment, landfill, shallow and deep soil removal, wetland restoration, thermal desorption installation).
- O & M cost = $28,727 (sediment/wetland monitoring).
- Periodic costs = $47,192 (5-year reviews).

SC-6B Costs
- Net present worth cost = **$43,524,762**
- Response time = 68 months.
- Capital cost = $36,217,633 (sediment, landfill, shallow and deep soil removal, wetland restoration, thermal desorption installation, thermally-enhanced SVE installation).
- O & M cost = $3,510,125 (sediment/wetland monitoring, SVE operation).
- Periodic costs = $47,192 (5-year reviews).

Treatment Components	• SC-6A: Excavation and on-Site thermal treatment of contaminated surface/shallow soil (0-10 feet bgs), deeper soil (>10 feet bgs) and sediment with off-Site disposal of limited hot-spots. Extraction wells to provide dewatering in the vicinity of deep soils to be excavated/treated. Restoration/construction of wetlands at the location where the landfill and sediment are excavated. • SC-6B: Excavation and on-Site thermal treatment of contaminated surface/shallow soil (0-10 feet bgs) and sediment with off-Site disposal of limited hot-spots. In-situ treatment through SVE of deep soil. Extraction wells to provide dewatering in the vicinity of the deep soils to be treated in-situ. Wells should be installed in conjunction with planned MOM. Restoration/construction of wetlands at the location where the landfill and sediment are excavated.
Containment Components	None
Institutional Control Components	• For SC-6B only: Establishment of activity and use restrictions, such as property deed restrictions (Site owner or Town ordinance) to protect the soil cap and prevent excavation below 10 feet. • State fishing advisory remains in effect.
Monitoring Requirements	• Long-term monitoring of remaining sediment and surface water. • Monitoring of wetland restoration activities.
Operation and Maintenance Requirements	• Repair of the existing fence and extension of the fence along Kelley Brook to enclose Parcels 1 and 2, as well as routine annual fence maintenance and repair until soil remediation is complete. • Quarterly Site inspections. • Review of Site conditions and risks at five year intervals.
Key ARARs	• Safe Drinking Water Act, Clean Water Act and TSCA are attained.
Long-Term Reliability	• Contaminants permanently addressed.
Quantity of Untreated Wastes and/or Residuals	None

Estimated Time to Design and Construct	27 months.
Estimated Time to Reach Remediation Goals	• SC-6A: 56 months. • SC-6B: 68 months.
Use of Presumptive Remedies or Innovative Technologies	• No presumptive remedies. • Thermally-enhanced SVE is an innovative technology.
Expected Reuse Outcomes	Both parcels available for residential use in 39 months.

2. Management of Migration (MOM) Alternatives Analyzed

Management of Migration (MOM) alternatives address contaminants that have migrated into and with the groundwater from the original sources of contamination. At the Site, contaminants have migrated from multiple combined sources located in the former operations area into the overburden aquifer which then flows in an easterly direction to Kelley Brook and into several off-Site receptors. A portion of the plume also dives into bedrock along the eastern border of the Site. The MOM alternatives analyzed for the Site include:

- MOM-1: No Action
- MOM-2: Limited Action
- MOM-3: Groundwater Collection and Treatment (High Pumping Rate)
- MOM-4: Groundwater Collection and Treatment (Low Pumping Rate)

Each of the four MOM alternatives is summarized below. A more complete, detailed presentation of each alternative is found in Section 4.4 of the FS Report.

MOM-1 No Action Alternative

Alternative MOM-1, the No Action Alternative, is intended to provide a baseline against which other alternatives can be compared, as required by the NCP. The No Action Alternative essentially consists of continuation of current maintenance and monitoring activities related to Site groundwater contamination in off-Site receptor wells.

- Net present worth cost = **$1,927,510**[12]
- Response time = approximately 40 years with source control and 100+ years without.
- Capital cost = $0

[12]Cost differs slightly from FS since the installation of a POE, and related costs ($16, 192), is not part of the no action remedy.

- O & M cost = $130,407 (groundwater monitoring, POE and well maintenance).
- Periodic costs = $20,391 (5-year reviews).

Treatment Components	Four existing Point of Entry (POE) treatment systems would remain necessary to supply safe water to receptors.
Containment Components	None
Institutional Control Components	None
Monitoring Requirements	• Annual sampling and analysis of groundwater from approximately sixteen existing "sentry" wells in downgradient portions of the contaminant plumes. • Periodic sampling and analysis of groundwater from residential water supply wells in the Site vicinity.
Operation and Maintenance Requirements	• Maintenance and repair of the sixteen sentry groundwater monitoring wells as needed. • Maintenance of the four existing POEs. • Review of Site conditions and risks at five year intervals.
Key ARARs	None. Risks not addressed, however standards used as baseline screening tools.
Long-Term Reliability	None
Quantity of Untreated Wastes and/or Residuals	• Approximately 1.6 billion gallons of untreated groundwater. • No treatment residuals.
Estimated Time to Design and Construct	None
Estimated Time to Reach Remediation Goals	Approximately 40 years with successful source control. Over 100 years without source control.
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	• Without source control, groundwater would not be available for Site reuse for 100+ years. • With the completion of source control, groundwater would potentially be available for Site reuse in about 40 years. • An alternate water supply could be used in the interim for reuse.

MOM-2 Limited Action

Alternative MOM-2 consists of measures, generally institutional controls and monitoring, to protect human health and the environment by limiting potential exposure to Site contaminants, but does not involve active treatment/removal of contaminants (beyond POEs).

- Net present worth cost = **$5,687,404**
- Response time = Approximately 40 years with source control and 100+ years without.
- Capital cost = $102,579 (one POE installation, AURs).
- O & M cost = $387,826 (groundwater monitoring, POE and well maintenance, fence repair).
- Periodic costs = $332,518 (5-year reviews, monitoring well abandonment).

Treatment Components	Four existing POE treatment systems would remain necessary to supply safe water to receptors.
Containment Components	None
Institutional Control Components	Establishment of a Groundwater Management Zone to restrict the use of groundwater.
Monitoring Requirements	• Annual sampling and analysis of groundwater from approximately 50 existing monitoring wells. • Periodic sampling and analysis of groundwater from residential water supply wells in the Site vicinity.
Operation and Maintenance Requirements	• Maintenance and repair of the 50 existing groundwater monitoring wells as needed. • Maintenance of the four existing POEs and installation/maintenance of potential additional POEs for residential supply wells. • Review of Site conditions and risks at five year intervals.
Key ARARs	None. Risks not addressed, however standards used as baseline screening tools.
Long-Term Reliability	Reliability of institutional controls (GMZ) requires effective oversight and enforcement.
Quantity of Untreated Wastes and/or Residuals	• Approximately 1.6 billion gallons of untreated groundwater. • No treatment residuals.
Estimated Time to Design and Construct	None

Estimated Time to Reach Remediation Goals	Approximately 40 years with successful source control. 100+ years without source control.
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	• Without source control, groundwater would not be available for Site reuse for 100+ years. • With the completion of source control, groundwater would be available for Site reuse in about 40 years. • An alternate water supply could be used in the interim.

MOM-3 Groundwater Collection and Treatment (High Pumping Rate)

Alternative MOM-3 includes all of the measures proposed under MOM-2, plus groundwater collection and treatment (at an assumed rate of 200 gpm) in the vicinity of source areas and receptors. In addition, natural attenuation is proposed for selected (less contaminated) source areas/groundwater plume areas (i.e., the solvent distillation unit plume, the SWRP 1 plume, and the portion of the UST/AST/SWRP 2 plume discharging to Kelley Brook). The objective of this alternative is to cleanup groundwater to MCLs/AGQS concentrations.

- Net present worth cost = **$15,582,540**
- Response time = Approximately 15 years.
- Capital cost = $5,937,850 (one POE installation, groundwater extraction/treatment system installation, AURs).
- O & M cost = $1,003,464 (treatment system maintenance, groundwater monitoring, POE and well maintenance, fence repair).
- Periodic costs = $1,306,253 (5-year reviews, treatment system demobilization, monitoring well abandonment).

Treatment Components	• A groundwater extraction system consisting of approximately seven extraction wells (five near source areas and two near off-Site receptors), pumps and piping. • A groundwater treatment system including: flow rate/contaminant concentration equalization, removal of metals (primarily iron and manganese) by chemical precipitation, and VOC removal by air stripping and activated carbon adsorption. • Sludge handling/processing equipment for the sludge produced as a result of the metals removal. Sludge will be disposed off-Site at an approved facility. • Vapor-phase activated carbon treatment system to control air emissions (likely to include on-Site steam regeneration). Spent carbon units will be sent off-Site to an approved facility. • A groundwater discharge system consisting of approximately 40 large diameter, vertical infiltration wells located in the western portion of Parcel 1, or if discharge limits allow, surface water discharge of treated groundwater to Kelley Brook. • Four existing Point of Entry (POE) treatment systems would remain necessary to supply safe water to receptors.
Containment Components	None
Institutional Control Components	Establishment of a Groundwater Management Zone to restrict the use of groundwater.
Monitoring Requirements	• Treatment system monitoring. • Semi-annual sampling and analysis of groundwater from approximately 50 monitoring wells. • Periodic sampling and analysis of groundwater from residential water supply wells in the Site vicinity.
Operation and Maintenance Requirements	• Maintenance and repair of the 50 groundwater monitoring wells as needed. • Maintenance of the four existing POEs and installation/maintenance of potential additional POEs for residential supply wells. • Review of Site conditions and risks at five year intervals.

Key ARARs	• SDWA MCLs. • DES AGQSs. • Clean Water Act. • Clean Air Act. • RCRA Hazardous Waste Rules. • TSCA.
Long-Term Reliability	• The extraction and treatment system consists of well proven technologies and is expected to be reliable. • Reliability of institutional controls (GMZ) requires effective oversight and enforcement.
Quantity of Untreated Wastes and/or Residuals	Treatment residuals estimated at 550 tons/year metals sludge, 10,000 pounds/year spent liquid phase carbon and 1,600 gallons per year of organic phase liquid (PCBs).
Estimated Time to Design and Construct	18 months.
Estimated Time to Reach Remediation Goals	• Approximately 15 years Site-wide. • Approximately 5 years for off-Site receptors.
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	• Without source control, groundwater would not be available for Site reuse for 100+ years. • With the completion of source control, groundwater would be available for Site reuse in about 15 years. • An alternate water supply could be used in the interim.

MOM-4 Groundwater Collection and Treatment (Low Pumping Rate)

Alternative MOM-4 is intended to protect human health and the environment using measures which include active groundwater remediation. Alternative MOM-4 is similar to MOM-3, except that MOM-4 includes a lower pumping rate (assumed pumping rate of 80 gpm) consistent with a less aggressive and lower capital cost groundwater collection/treatment approach as compared to MOM-3, but with a correspondingly longer predicted time frame for cleanup. In addition, natural attenuation is proposed for selected source areas/contaminated groundwater plume areas (i.e., the solvent distillation unit plume, the SWRP 1 plume, and the portion of the UST/AST/SWRP 2 plume discharging to Kelley Brook). The objective of this alternative is to cleanup groundwater to MCLs/AGQS concentrations.

- Net present worth cost = **$15,527,152**
- Response time = Approximately 35 years.
- Capital cost = $4,452,900 (one POE installation, groundwater extraction/treatment system installation, AURs).
- O & M cost = $844,240 (treatment system maintenance, groundwater monitoring, POE and well maintenance, fence repair).
- Periodic costs = $1,036,925 (5-year reviews, treatment system demobilization, monitoring well abandonment).

Treatment Components	• A groundwater extraction system consisting of approximately seven extraction wells (five near source areas and two near off-Site receptors), pumps and piping. • A groundwater treatment system including: flow rate/contaminant concentration equalization, removal of metals (primarily iron and manganese) by chemical precipitation, and VOC removal by air stripping and activated carbon adsorption. • Sludge handling/processing equipment for the sludge produced as a result of the metals removal. Sludge will be disposed off-Site at an approved facility. • Vapor-phase activated carbon treatment system to control air emissions (likely to include on-Site steam regeneration). Spent carbon units will be sent off-Site to an approved facility. • A groundwater discharge system consisting of approximately 40 large diameter, vertical infiltration wells located in the western portion of Parcel 1, or if discharge limits allow, surface water discharge of treated groundwater to Kelley Brook. • Four existing Point of Entry (POE) treatment systems would remain necessary to supply safe water to receptors.
Containment Components	None
Institutional Control Components	Establishment of a Groundwater Management Zone to restrict the use of groundwater.
Monitoring Requirements	• Treatment system monitoring. • Semi-annual sampling and analysis of groundwater from approximately 50 monitoring wells. • Periodic sampling and analysis of groundwater from residential water supply wells in the Site vicinity.

Operation and Maintenance Requirements	• Maintenance and repair of the 50 groundwater monitoring wells as needed. • Maintenance of the four existing POEs and installation/maintenance of potential additional POEs for residential supply wells. • Review of Site conditions and risks at five year intervals.
Key ARARs	• SDWA MCLs. • DES AGQSs. • Clean Water Act. • Clean Air Act. • RCRA Hazardous Waste Rules. • TSCA.
Long-Term Reliability	• The extraction and treatment system consists of well proven technologies and is expected to be reliable. • Reliability of institutional controls (GMZ) requires effective oversight and enforcement.
Quantity of Untreated Wastes and/or Residuals	Treatment residuals estimated at 550 tons/year metals sludge, 10,000 pounds/year spent liquid phase carbon and 1,600 gallons per year of organic phase liquid (PCBs).
Estimated Time to Design and Construct	18 months.
Estimated Time to Reach Remediation Goals	• Approximately 35 years Site-wide. • Approximately 12 years for off-Site receptors.
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	• Without source control, groundwater would not be available for Site reuse for 100+ years. • With the completion of source control, groundwater would be available for Site reuse in about 35 years. • An alternate water supply could be used in the interim.

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section l2l(b)(1) of CERCLA presents several factors that, at a minimum, EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the

National Contingency Plan (NCP) articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

The nine criteria fall into three general categories: threshold criteria *must* be met for an alternative to be eligible for selection and include overall protection of human health and the environment and compliance with ARARs; primary balancing criteria are used to compare and evaluate elements of each alternative and include long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability and cost; and modifying criteria are used as a final evaluation step for each alternative following the receipt of public comment and include state and community acceptance.

A comparative analysis was performed on each of the six source control alternatives and each of the four management of migration alternatives using the nine evaluation criteria in order to select a Site remedy. All source control alternatives assume implementation of an effective management of migration alternatives; similarly, the same is true for management migration alternatives in that they rely on an effective source control remedy. This comparative analysis can be found in Table 5-7 for Source Control alternatives and Table 5-12 for Management of Migration alternatives as developed in the FS Report.

The section below provides a brief overview of the six source control and the four management of migration alternatives followed by a summary of the strengths and weaknesses of each alternative according to the detailed comparative analysis for the nine criteria.

Threshold Criteria

① **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

Source Control Alternatives

Alternatives SC-1(no action) and SC-2 (limited action) would not be protective of human health or ecological receptors since neither include active remediation to address site risks and contaminated media exposed to the elements and trespassers. As a result SC-1 and SC-2 will not be carried forward in this comparison.

Alternative SC-3 (soil cover) would offer considerably greater protection than SC-1 or SC-2, however it would not be protective of human health for unrestricted (residential) future use since soil contamination would remain at a depth of two feet beneath the ground surface. Alternative SC-3 would be protective of ecological receptors provided that the soil cover is properly maintained to prevent exposure to burrowing organisms.

Alternatives SC-4, SC-5, and SC-6 are superior to SC-3 and are equally protective of human health and ecological receptors since contaminated soil to a depth of ten feet beneath the ground surface would be excavated for treatment or disposal and institutional controls would prevent exposure to soils beneath ten feet.

Management of Migration Alternatives

Similar to SC-1 and SC-2, alternative MOM-1 (no action) would not be protective of human health or ecological receptors since no action is taken to address site risks nor are institutional controls in place. As a result, MOM-1 will not be carried through the rest of the comparison of alternatives.

Alternatives MOM-2 (limited action), MOM-3 and MOM-4 would be equally protective of human health since each relies on institution controls (i.e., a GMZ) to restrict the use of contaminated groundwater until drinking water standards (MCLs/AGQSs) are achieved. In addition, these alternatives include maintenance of existing POEs, and the installation of new POE treatment units as necessary, to prevent human exposure to groundwater with contaminant concentrations above drinking water standards. In general, MOM-2 would not be protective of ecological receptors because contaminated groundwater would continue to discharge to Kelley Brook unabated.

Overall, MOM-3 significantly reduces risks associated with groundwater use in the least amount of time, 15 years assuming source control is in place, than any other alternatives.

② **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked under CERCLA 121(d)(4). Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain ARARs, unless they are waived.

<u>Applicable requirements</u> are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant or contaminant, the remedial action to be implemented , location or other circumstance found at a CERCLA site. State requirements that are more stringent than Federal requirements are ARARs for affected media.

<u>Relevant and appropriate requirements</u> are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under Federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, the remedial action at the Site location or other circumstance at a CERCLA site, addresses problems or situations sufficiently similar to those encountered at

the CERCLA site that their use is well-suited to the particular site. Again, state requirements that are more stringent than Federal requirements for the affected media may be relevant and appropriate.

Source Control Alternatives

Alternatives SC-3, SC-4, SC-5, and SC-6 will meet federal and state groundwater standards (MCLs/AGQS) and will prevent further degradation of surface water at the completion of the remedy because these alternative, either through treatment and/or removal, reduce leaching from deep soils which are the primary sources of groundwater and surface water contamination. State surface water standards will be used to measure the performance of deep soil remediation.

SC-3 will comply with state and federal solid waste regulations for capping landfills and long-term monitoring of the cap. Alternatives SC-3, SC-4, SC-5 and SC-6 will comply with state and federal solid and hazardous waster requirements for material handling during excavation of source materials through pre-excavation characterization for disposal and live loading of material to avoid stockpiling. Alternatives that involve SVE or thermal desorption will meet RCRA and state requirements for containers, air emissions and well installation and abandonment.

All alternatives that involve excavation and or treatment will remove PCB contaminated material below 50 ppm and dispose of offsite at an appropriate facility. Similarly these alternatives will all comply with wetlands and floodplain requirements through the use of silt fences and hay bales; however, SC-3 capping activities are site-wide and therefore require wetland mitigation through replacement. The remaining alternatives, while disruption, allow for replanting of the existing wetlands.

Management of Migration Alternatives

Alternative MOM-2 does not actively address groundwater or surface water contamination (beyond use of POEs). When combined with a source control remedy, it could meet drinking water standards in groundwater within approximately 40 years through natural attenuation. Surface water would continue to be degraded for a similar amount of time until groundwater sources to surface water has attenuated.

Alternatives MOM-3 and MOM-4 directly address groundwater contamination, and therefore, are compliant with groundwater, drinking water, and surface water ARARs. For both alternatives, discharge of treated groundwater to Kelley Brook, if implemented, would comply with surface water discharge criteria. Similarly, if groundwater infiltration is chosen as a discharge method, the discharged water will meet drinking water standards. The primary construction activities completed in association with the implementation of MOM-3 and MOM-4 (i.e., construction of groundwater extraction, treatment and discharge system) would be outside of wetland/floodplain areas. Relatively minor construction and other activities potentially completed in the wetland/floodplain (e.g., fence construction/maintenance, surface water discharge) would comply with these ARARs, and would minimize impacts to the extent practicable.

These two alternatives would also provide for proper disposal of PCB contaminated media (e.g., recovered free-product oil), consistent with TSCA regulations. Activities performed in the construction and operation of these alternatives would be compliant with DES and RCRA hazardous waste rules. During construction and operation of the proposed groundwater extraction, treatment and discharge systems, air pollution regulations would be complied with by controlling fugitive dust and VOC emissions.

Both alternatives will meet site ARARs assuming effective source control is in place; however, MOM-3 will achieve these standards in less time (15 years) than MOM-4 (35 years).

Primary Balancing Criteria

③ **Long-term effectiveness and permanence** refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain on-Site following remediation and the adequacy and reliability of controls.

Source Control Alternatives

Alternatives SC-4, SC-5 and SC-6 would provide the most reliable permanent protection to human and ecological receptors through the excavation and off-Site removal or treatment of contaminated shallow soil (<10 feet deep). Alternatives SC-4 and SC-5 would enjoy the highest degree of effectiveness and permanence since contaminated soil would be excavated and removed from the Site and replaced with clean material. SC-6 replaces the excavated soils back onsite after treatment. While this treatment is expected to be permanent, its effectiveness would be assessed through long term groundwater monitoring and evaluations. SC-3 provides the least reliable permanent protection in that shallow soils are capped throughout the entire site after hot spot excavation occurs. Long-term protection is completely reliant on proper cap maintenance. Even with capping, burrowing organisms could be exposed to contaminated soil beneath the portions of the site with only a soil cover.

With regard to deeper soils (>10 feet deep), alternatives SC-3, SC-4, SC-5 and SC-6 would provide reliable permanent protection to human receptors through the removal or treatment of VOCs which are a source of groundwater contamination. Alternative SC-4 would enjoy the highest degree of effectiveness and permanence since contaminated soil would be excavated and removed from the Site and replaced with clean material. In-situ treatment of deep soil through vapor extraction under SC-5 and SC-6B, and ex-situ on-Site treatment by thermal desorption under SC-6A, would permanently eliminate the VOC source of groundwater contamination.

Again, this treatment is expected to be permanent; however, the effectiveness of these treatment alternatives would be assessed through long term groundwater monitoring and evaluations.

All alternatives rely in some degree on institutional controls. SC-3 prohibitions against digging into the hazardous waste cap and soil cover would remain in place as long as the waste beneath it poses a risk. For all alternatives, controls against using the groundwater for drinking water will presumably be lifted when the remedy is complete, and controls against disturbing soils below 10 feet will remain in place unless further action is taken to address these contaminants.

Management of Migration Alternatives

Alternative MOM-2 would provide the least amount of long term effectiveness or permanence because no active remedial measures are included and it instead relies on natural attenuation and institutional controls to prevent exposure to future users for the next 40 years.

While MOM-3 and MOM-4 also rely on institutional controls to prevent exposure, MOM-3 requires these control to remain in place for the least amount of time because the groundwater extraction system is larger and the rate of pumping is higher.

Each alternative provides some degree of long-term protectiveness. MOM-3 and MOM-4 have a higher degree of long-term effectiveness since they rely on well-proven technology to treat groundwater. MOM-2 on the other hand has less certainty than an active treatment alternative due to the fact that it relies on natural processes beyond our control.

MOM-3 is preferable to the other alternatives because it achieves long-term effectiveness and permanence in the shortest amount of time.

④ **Reduction of toxicity, mobility, or volume through treatment** refers to the anticipated performance of the treatment technologies and addresses the degree to which alternatives employ recycling or treatment, including how treatment is used to address the principal threats posed by the Site.

Source Control Alternatives

All the alternatives reduce the toxicity, mobility and volume of contamination through treatment in varying degrees, although alternative SC-4 does not involve onsite treatment for any contaminated media but instead excavates and sends both shallow and deep soils and excavated sediment offsite for disposal. Conversely, SC-6 sends very little contaminated media offsite for disposal (limited sediment and possibly a small amount of lead contaminated soils) and instead treats both shallow and deep soils onsite. SC-5 strikes a balance between SC-4 and SC-6 in that it excavates and sends offsite for disposal shallow soil and some sediment and treats in place deeper soils. Alternative SC-3, treats only deeper soils insitu. and excavates for off-Site disposal contaminated hot spot surface/shallow soil, leaving the remainder of the shallow soil capped in place.

More specifically, alternatives SC-4 and SC-5 excavate and dispose off-Site approximately 67,000 cubic yards of contaminated surface/shallow soil, 1,100 cubic yards of contaminated sediment, and 10,700 cubic yards of landfill related media (solid/hazardous waste and contaminated soil). SC-3 removes approximately 1,600 cubic yards of contaminated shallow soil and 1,100 cubic yards of contaminated sediment, capping approximately four acres. Alternative SC-6 treats on-Site approximately 58,000 cubic yards of contaminated surface/shallow soil and 1,100 cubic yards of contaminated sediment by ex-situ low temperature thermal desorption. In addition, approximately 4,000 cubic yards of solid/hazardous waste and approximately 15,000 cubic yards of "high lead" soil would not be treatable by thermal desorption would be treated/disposed off-Site. All alternatives except SC-4 will treat approximately 70,000 cubic yards of deeper soil; SC-4 excavates and sends offsite for disposal a similar volume of deeper soil.

All alternatives permanently remove organic contaminants from soil/sediment through excavation or treatment; however, those alternatives involving treatment produce treatment residuals (SC-3, 5, and 6). Treatment technologies include soil vapor extraction (possibly thermally enhanced) and low temperature thermal desorption. These technologies are well-established and have a high degree of effectiveness in removing organic contamination from soil. They do, however, produce residual contamination. Residuals include recovered condensed "oil-phase", activated carbon from the air emission control system; and potentially HEPA filters, filter cake (from wastewater treatment), and liquid-phase activated carbon (from wastewater treatment). These residuals would be disposed off-Site. SC-4, because it is entirely dependent on excavation does not produce residuals. Whether contaminants are removed through excavation or through treatment, site risks from PCB exposure are reduced and the primary VOC source of groundwater contamination is eliminated..

SC-4, although it reduces site risks like the other alternatives, does not meet the criteria for reducing toxicity, mobility or volume through treatment. SC-3 and 5 partially rely on treatment in deeper soils. SC-6 achieves the greatest reductions toxicity, mobility and volume though treatment of both shallow and deeper soil, however generates the greatest quantity of residuals.

Management of Migration Alternatives

MOM-2 does not reduce toxicity, mobility, or volume through treatment (beyond the use of POEs).

Alternatives MOM-3 and MOM-4 both produce similar volumes of treatment residuals. Because MOM-3 pumping rates are faster than MOM-4, residuals accumulate on site sooner than MOM-4; however, the total volume of residuals are similar.

The assumed design flow rate for Alternative MOM-3 would be approximately 200 gpm, which equates to approximately 1.6 billion gallons of groundwater over the estimated 15-year operational period for the system. The assumed design flow rate for MOM-4 would be approximately 80 gpm, which equates to approximately 1.5 billion gallons of groundwater over the estimated 35-year operational period for the system. Given that MOM-3 achieves cleanup levels in 15 years, it has the advantage of reducing the toxicity, mobility and volume of the contaminated groundwater plumes approximately 20 years sooner than MOM-4. Likewise, MOM-3 reduces vapors associated with the VOCs in a similar time frame.

⑤ **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup levels are achieved.

Source Control Alternatives

Alternatives SC-4 and SC-6A require the most handling of contaminated media, thereby posing the highest degree of short term risks to workers and the community from fugitive dust and VOC emissions. SC-5 and SC-6B include a component of insitu treatment which reduces these risks; however some material handling still occurs. SC-3 involves the least amount of excavation, earth moving and backfilling and therefore poses the lowest risk to onsite workers and surrounding community. These emissions will be controlled by engineering measures such as wetting or the use of dust suppressants and, in the case of VOCs, potentially foam or some other means of limiting VOC emissions. Additional air emissions from the treatment of deep soil under Alternatives SC-3, 5 and 6 will be controlled through the use of carbon filters or combustion to prevent exposure to workers and surrounding community. Other precautions common to all alternatives include the use of air monitoring and personal protective equipment.

Likewise, each alternative require trucking of both hazardous and non-hazardous material on and offsite through a densely populated, residential community. The amount of truck traffic follows in order, from highest impact to least impact from truck traffic safety concerns alone. All hazardous material will be transported in lined, covered trucks which have been decontaminated onsite to minimize potential exposure during transportation:

- SC-4 would require 50 trucks/day for about 380 work days,
- SC-5 would require 50 trucks/day for about 230 work days,
- SC-6A would require 50 trucks/day for about 140 work days,
- SC-3 would require 50 trucks/day for about 80 work days, and
- SC-6B would require 50 trucks/day for about 50 work days.

Dewatering activities associated with the remediation of deep soils as part of alternatives SC-3, SC-4, SC-5 and SC-6 will result in a temporary lowering of the water table in the immediate vicinity of the Site. This could cause six shallow overburden water supply wells to dry up. In order to prevent an interruption in water service to these well users, these active supply wells will be replaced with bedrock wells prior to the start-up of dewatering activities.

The principal environmental concern associated with alternatives SC-3, SC-4, SC-5, and SC-6 is the potential impact to the ecology of the Kelley Brook wetlands. All four of these alternatives include excavation of contaminated sediment from Kelley Brook. Erosion/sediment transport in the Kelley Brook wetlands can be mitigated/controlled by engineering methods such as siltation fences. In general, alternatives SC-4 and SC-6A have a greater potential for erosion into wetlands due to the higher volumes of soil excavated adjacent to Kelley Brook. Alternative SC-3 would have the least erosion into the wetland due to minimal excavation activities.

In addition, dewatering for remediation of deeper soils (SC-3,4 5 and 6) tend to induce infiltration of surface water from Kelley Brook which already has low summer flow rates. Water levels within the Kelley Brook wetland area would be continually monitored. Extraction rates would be adjusted if water levels drop to unacceptable levels and/or stressed vegetation suggests greater hydration is needed.

The time frames to achieve RAOs would be least (approximately 3 years) for alternatives SC-3 and SC-4, longer (approximately 4-5 years) for SC-5, and greatest (approximately 5-6 years) for alternative SC-6.

Management of Migration Alternatives

The implementation of Alternative MOM-2 would not pose additional risks or impacts to the local community or environment since no active remedial measures would be performed.

Alternatives MOM-3 and MOM-4 present similar short-term adverse impacts from site cleanup activities, including fugitive dust from construction activities, truck traffic, and short-term stockpiling of treatment residuals. For both alternative, these adverse impacts can be controlled through engineering processes or other appropriate measures. Groundwater extraction will result in a lowering of the water table which impacts both shallow drinking water wells and the ecology of Kelly Brook. These impacts appear to be more significant for MOM-3, given its higher pumping rate, and, as a result, six supply wells will be replaced before pumping begins. MOM-4 does not include well replacement given its lower pumping rate; however, water levels will be closely monitored and similar action may be necessary.

Risks to workers from air emissions and contact with contaminated media while performing remedial and monitoring activities as part of alternatives MOM-3 and MOM-4 will be controlled and mitigated through the use of proper health and safety measures such as air monitoring and personal protection equipment.

Finally, construction and installation of the groundwater extraction, treatment and discharge systems would require approximately 12 to 18 months for both alternatives MOM-3 and MOM-4.

⑥ **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Source Control Alternatives

The shallow soil, deep soil, sediment excavation, wetlands restoration/construction and covering/capping included in the various alternatives would be readily implementable. Available information indicates that several facilities would accept the quantities of soil/sediment considered for off-Site disposal. Personnel, equipment, and materials would be readily available for soil/sediment excavation, wetlands restoration/construction, and capping.

Soil vapor extraction (SVE) for removal of VOCs from the deep soil is a proven technology and would be readily implementable under alternative SC-3, SC-5 and SC-6B. Thermal-enhancement of the SVE system through steam injection, if deemed necessary, is a relatively new technology; however, several full-scale projects have demonstrated its constructability and effectiveness. Specialized firms with skilled personnel would be required for the design, construction and operation of the thermally-enhanced SVE system.

The on-Site, ex-situ thermal desorption of contaminated soils proposed as part of alternatives SC-6A and SC-6B is a relatively new technology; however, its implementability and effectiveness have been demonstrated at numerous Sites by multiple vendors/contractors. Specialized firms with skilled personnel would be required for the setup and operation of the on-Site, ex-situ thermal desorption system.

Dewatering would be required to remediate the deeper soils; therefore a MOM alternative with adequate capacity would be required to implement these alternatives.

Deed restrictions will be necessary under alternative SC-3 to preserve the integrity of the Site soil cover/RCRA cap and will require cooperation of the site owners and may be administratively difficult to obtain. Except for SC-4, all alternatives will require restrictions against digging below 10 feet.

Management of Migration Alternatives

Institutional controls would be required for alternatives MOM-2, MOM-3 and MOM-4 to prevent the use of groundwater until drinking water standards are obtained. The success of institutional controls in preventing exposure to human receptors requires cooperation from affected property owners and enforcement of these restrictions. Access for long-term monitoring for all alternative MOM-2 and for construction activities for MOM-3 and MOM-4 will involve similar levels of cooperation from affected property owners. In addition, all the alternatives rely on an existing state fish advisory that advises using caution when consuming fish.

Alternative MOM-2 is most easily implemented in that it only involves maintaining POE systems on supply wells. System parts are readily available. MOM-3 and MOM-4, in addition to maintaining POE systems, include construction and maintenance of a groundwater extraction, treatment and discharge system onsite as well as offsite disposal of treatment residuals.

The groundwater extraction and treatment systems consist of proven and reliable methods and components. The personnel, equipment and materials for construction, installation and operation of the groundwater extraction and treatment system are readily available. Offsite licensed waste disposal facilities are available to accept the treatment residuals. These systems can be modified as necessary to reach cleanup levels.

Operation and maintenance of the groundwater extraction, treatment and discharge systems for both alternative is identical and generally includes cleaning and replacement of well components, regeneration of activated carbon, maintenance of blower equipment, and cleaning of filter presses.

⑦ **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Source Control Alternatives

	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6A	SC-6B
Capital Cost	$0	$99,306	$9.25 million	$41.23 million	$24.42 million	$57.27 million	$36.21 million
Net Present Worth Cost	$156,912	$1.47 million	$17.98 million	$41.53 million	$31.81 million	$57.58 million	$43.55 million

Although alternative SC-3 is $14 million less than the selected alternative SC-5, contamination would remain at a depth less than 10 feet below the ground surface and thus would not be protective for the desired future residential use of the property. Also, alternative SC-3 may not be protective for ecological receptors such as burrowing mammals. The remaining source control alternatives, SC-4 and SC-6 are considerably more expensive than SC-5 for similar levels of treatment.

Management of Migration Alternatives

	MOM-1	MOM-2	MOM-3	MOM-4
Capital Cost	$16,192	$102,579	$5.94 million	$4.45 million
NPW Cost	$1.93 million	$5.69 million	$15.58 million	$15.53 million

Although MOM-2 would protect human health through institutional controls and is the least expensive, it requires about 40 years (with effective source control) to restore groundwater quality to existing impacted supply wells, requiring long-term reliance on POEs. MOM-4 provides a similar level of protectiveness as MOM-3 for a similar cost, but would require about twice the estimated time-frame to achieve drinking water quality.

Modifying Criteria

⑧ **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

The State supports the source control component of the selected remedy which includes excavation and active treatment to allow for residential reuse of the Site property. The State supports the management of migration component of the selected remedy because it restores groundwater in this State-designated High-Value aquifer to drinking water standards in the shortest possible time frame.

A letter from the State of New Hampshire’s Department of Environmental Services documenting concurrence on the selected remedy, as presented in this ROD, is attached in Appendix **A.**

⑨ **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report. A complete summary of comments submitted by the general public and several PRPs are contained in the Responsive Summary, which is Part 3 of this ROD.

Source Control Alternatives

With regard to source control options, the public generally supported alternatives SC-4, SC-5 and SC-6 since they would all involve removal and/or destruction of the sources of contamination and will allow for restoration of the Site property to be used for residential purposes. The Town of Plaistow recently approved reuse plans which include mixed residential/recreational use of the property. Some of the local residents were concerned about the noise and traffic that would be generated from these same alternatives.

Management of Migration Alternatives

With regard to management of migration options, the public supported MOM-3 because it restores groundwater in currently impacted supply wells, and throughout the aquifer, to drinking water standards in the shortest possible time frame. Informational letters were sent to six property owners with shallow supply wells on August 9, 2002 (see Appendix G). None of these property owners voiced opposition to this alternative.

L. THE SELECTED REMEDY

The selected remedy is a comprehensive approach which utilizes source control (alternative SC-5) and management of migration (alternative MOM-3) to address the principal Site risks.

1. Summary of the Rationale for the Selected Remedy

The source control remedy was selected because it protects human health and the environment, complies with all ARARs and will allow for unrestricted[13] future use of the Site (including residential development consistent with current zoning). It involves the excavation and off-Site disposal of contaminated soil exceeding clean-up standards to a depth of ten feet. The majority of contaminated soil is located to a depth of two feet over a large area of Parcel 1, with discreet areas extending deeper. Soil contamination on Parcel 2 is limited to an area immediately adjacent to and bordering Parcel 1. Removal of this soil will protect existing trespassers and allow for unrestricted residential reuse of the entire property. Additionally, a limited area of oil-saturated sediment will be excavated from Kelley Brook to eliminate ongoing chemical releases to surface water and protect trespassers, waders, and ecological receptors. Deeper soil will be treated by soil vapor extraction, which may require thermal-enhancement through steam injection, to remove VOCs which are an ongoing source of groundwater contamination. Institutional controls will be required to prevent digging in soil below ten feet since contaminants other than VOCs will remain in these soils.

[13]Contamination in deep soils (> 10 feet bgs) are considered inaccessible to current and future human receptors and will be remediated in-situ to remove VOCs only. Because unacceptable levels of contaminants other than VOCs will remain after treatment, and because the State considers 0-15 feet accessible for unlimited use, institutional controls will restrict digging below 10 feet.

The management of migration remedy was selected because it protects human health and the environment, complies with ARARs and restores groundwater quality for existing and future users in the shortest time frame. It involves the extraction and on-Site treatment and discharge of contaminated groundwater to remove VOCs and metals and ultimately restore the aquifer to drinking water standards. Institutional controls will include establishing a Groundwater Management Zone, under New Hampshire groundwater protection regulations, on Parcels 1 and 2 and wherever groundwater exceed drinking water standards offsite. These restriction prevent the potable use of groundwater. Monitoring of area groundwater through existing on-Site test wells and supply wells will be performed to ensure protection of existing well users, determine the effectiveness of source control measures and evaluate progress towards achieving cleanup standards. Monitoring of air quality in structures within the vicinity of the Site for excess vapors will be conducted when EPA determines it is appropriate and if unsafe levels are found mitigation measures may be necessary.

2. Description of Remedial Components

As part of the pre-design phase of the remedy, several activities must occur. These activities consist of treatability studies; and assessments of the LNAPL treatment system; an on-Site water supply well; an existing on-Site commercial building; and Site access. Each of these activities is described in more detail below.

Treatability Studies

Two (2) distinct field scale pilot tests (or treatability studies) will be performed to provide additional data for the final remedial design. These studies will be performed concurrently. The scope and duration will be determined by EPA, in its sole discretion, during pre-design. These studies must conclude prior to the initiation of remedial design activities; but may run concurrently with the operation of the LNAPL treatment system.

1. Thermal-Enhancement Study - The source control remedy includes an SVE system to remove VOCs from deeper soil to prevent leaching into groundwater. The treatability study will provide data that will enable EPA to determine, in its sole discretion, the need for thermal enhancement of the SVE system. Conceptually, this study will involve the installation of a minimum of three SVE extraction wells and a sufficient number of steam injection wells. Increasing amounts of steam will be applied during the treatability study. VOC removal rates and other factors will be measured.

2. Groundwater Treatment Study - The management of migration remedy includes constructing a groundwater extraction and treatment system to restore groundwater quality to drinking water standards within an estimated 15 year time frame. As a conceptual design, the system will be capable of extracting approximately 200 gallons/minute through a series of seven extraction wells and re-infiltration of groundwater through 40 large diameter infiltration wells.

The treatability study to be performed within the plume area will determine the exact number of extraction wells, the appropriate well locations/depths, the most effective extraction rate, and the most effective effluent discharge method before the system is finally designed.

The study will focus on the hydrogeologic properties of the aquifer to design the groundwater collection and treatment system. An aquifer pumping test will be implemented to obtain data (e.g., hydraulic conductivity, specific yield, specific capacity, extent of groundwater capture) relevant to the selection of extraction well design parameters necessary to achieve contaminated groundwater recovery objectives. Groundwater treatability testing shall be conducted concurrent with aquifer testing to characterize extracted groundwater quality, evaluate the effectiveness of proposed treatment processes, and assist in the final selection and sizing of treatment equipment.

The study will also evaluate two additional factors: (1) the extent of additional groundwater extraction needed, if any, for water table depression associated with the in-situ SVE treatment of deep soil; and (2) data collection to allow EPA to determine, in its sole discretion, the viability of surface water discharge or recharge of treated water to groundwater.

Assessment of LNAPL extraction system

Access to the shallow and subsurface soil is currently limited by the 143 extraction wells and piping associated with the existing LNAPL vacuum extraction system. Prior to initiating source control design, an assessment will be made of the vacuum extraction system components for use in constructing other parts of the remedy.

Assessment of on-Site water supply well

An active bedrock supply well (WS-2) is located on Parcel 1, near the location of the former office building. This well serves an adjacent property owner's home and was installed by the owner of Parcel 1 to replace the homeowner's contaminated shallow well. Pre-design assessment will be performed to allow EPA to determine, in its sole discretion, the nature and extent of impacts the remedial design, construction and operation of the remedy will have on the supply well and the associated plumbing and wiring. Corrective action shall be taken to remedy any impacts.

Assessment of existing Site building

An assessment of the existing commercial building on Parcel 1 shall be conducted to determine its condition for possible use during performance of clean-up activities. The building structure, utilities, size, layout, insulation and other factors will be documented. If deemed adequate, the building may be used to house administrative offices, on-Site laboratories, storage and/or treatment components associated with the selected remedy.

Evaluation of Site access

The source control remedy requires as many as 50 trucks per day to travel to and from the Site. The FS Report identifies the existing Kelley Road entrance as the only access point to the 40 acre property. Kelley Road is a narrow residential roadway. Pre-design studies shall evaluate alternative access routes. The objective of this evaluation is to locate additional access points which will minimize impacts to local infrastructure and avoid residential areas, to the extent practicable, such that material can be conveyed to and from the Site in the most efficient, safe and non-disruptive manner possible.

Source Control Alternative SC-5 (Excavation and Off-Site Treatment/Disposal of Shallow Soil, and In-Situ Deep Soil Treatment)

The selected remedy includes the following key components, in order of completion:

I. Site clearing and staging activities;

II. Excavation of contaminated surface/shallow soil (generally 0 to 2 feet bgs), including soil piles, as well as subsurface soil (discreet areas 2 to 10 feet bgs) for off-Site disposal;

III. Excavation of the on-Site landfill materials for off-Site disposal;

IV. Excavation of certain contaminated Kelley Brook sediment for off-Site disposal;

V. Restoration of Kelley Brook wetlands in the landfill and sediment excavation areas;

VI. Installation of the management of migration component of the remedy to provide a treatment facility for effluent associated with the dewatering activities necessary for insitu SVE;

VII. Performance of the in-situ treatment of deep soil using soil vapor extraction (SVE) to address VOCs which are acting as a continuing source of groundwater contamination. The SVE system may be thermally-enhanced through steam injection as determined by the treatability study described above; and

VIII. Obtain institutional controls

I. <u>Site clearing and staging activities</u>

- Fence repair;

- Establish staging and decontamination area;

- Remove existing LNAPL vacuum extraction system;
- Field survey to establish control for excavation boundaries and in-place disposal characterization sampling;
- Implement erosion control measures around the perimeter of the excavation area;
- Clear and grub small trees and heavy brush within the excavation area;
- Remove and dispose off-Site sand blast grit pile (approximately 80 cubic yards);
- Remove the former AST concrete containment structure, concrete debris from the rubble storage area, and the concrete pad near Soil Pile No. 8 (approximate total of 1,300 tons), and dispose off-Site the concrete demolition debris;
- Remove and dispose off-Site the tire pile located on Parcel 1 (approximately 24 cubic yards);
- Remove miscellaneous concrete/debris items, including the subsurface oil/water separator located near the southern corner of the newer Site building, the catch basin located adjacent to SWRP2 and the concrete debris from the former concrete lined tank T-137 (remaining from the removal action completed in 1997), with off-Site disposal of concrete demolition debris. Similar additional underground structures may be present and must be removed prior to, or in conjunction with, soil excavation (including old building foundation);
- Protect the buried piping and electrical service for water supply well WS-2 located within the landfill area; and
- Relocate approximately six monitoring wells located within or adjacent to the landfill.

II. <u>Excavate Contaminated Surface/Shallow Soil (Generally 0 to 2 feet bgs), Including Soil Piles, as Well as Subsurface Soil (Generally 2 to 10 feet bgs) for Off-Site Disposal</u>

Active remediation of surface/shallow soil contaminants (i.e., 0 to 2 feet bgs) and subsurface soil contaminants (i.e., 2 to 10 feet bgs) will occur via excavation and off-Site disposal. Excavation of surface/shallow and subsurface soil will proceed with pre-excavation disposal characterization sampling/analysis, and excavation in four phases.

The existing asphalt pavement area near the Site entrance/exit to Kelly Road will remain in place to serve as a convenient equipment staging and decontamination area for the majority of the Site soil excavation activities. Once these activities are completed, the equipment will be relocated to another area of the Site and the asphalt and underlying soil will be excavated as part of the last excavation phase of shallow soil removal.

Excavation begins with the most highly contaminated areas “hot spots”(Phase I), then addresses the lesser contaminated surface/shallow soil [i.e., generally 0 to 2 feet bgs] (Phase II), proceeds to subsurface contaminated soil [i.e., 2 to 10 feet bgs] (Phase III), and finishes with contaminated soil beneath the existing asphalt paved areas (Phase IV). Sequencing excavation based on degree of soil contamination and location on Site limits potential cross-contamination of relatively less contaminated and more contaminated soil and associated increases in volume and disposal costs, and facilitates the flow of equipment/truck traffic on and off the Site.

Once the shallow soil is removed, excavation activities will address the soil piles.

Phase I - ‘Hot Spot’ Excavation: This phase involves excavation of surface/shallow soil “hot spots” containing PCBs and/or metals (primarily lead) at concentrations that require disposal as TSCA (i.e., PCBs ≥ 50 ppm) and/or RCRA hazardous waste.

Excavated hot spot soils will be temporarily stored on-Site for disposal characterization sampling and analysis. Based on the results of disposal characterization sampling/analysis, the soil will be sent to a TSCA or RCRA subtitle C facility for disposal or, if non-hazardous (<50 ppm) to a RCRA subtitle D facility. For the purpose of estimating disposal costs, the following breakdown of hot spot soil volumes and disposal categories are presumed based on available data:

Soil Contaminant/Disposal Category	Presumed Type of Treatment/Disposal Facility	Estimated Contaminated Soil Volume (cubic yards)
PCBs 1 to 49 ppm, high lead	RCRA-hazardous	486
PCBs ≥ 50 ppm, low lead	TSCA/RCRA-hazardous	772
PCBs ≥ 50 ppm, high lead	TSCA/RCRA-hazardous	53
	TOTAL “HOT SPOT” SOILS:	**1,311**

Samples will be collected from each completed excavation area for laboratory analysis to confirm removal of soils exceeding cleanup standards. Laboratory analysis will focus, at a minimum, on PCBs and total lead, which drive the cleanup.

Phase II - Non-Hot Spot Surface/Shallow Soil Excavation: This phase involves excavation of surface/shallow soils with contaminant concentrations above cleanup levels, but at concentrations which will not require treatment/disposal as TSCA-hazardous and/or RCRA hazardous waste. The estimated soil volume of 35,503 cubic yards in this disposal category (i.e.

PCBs 1 to 49 ppm, low lead) represents the majority of the contaminated surface/shallow soil volume. This soil is located over the majority of the developed portion of Parcel 1 and the westernmost portion of Parcel 2.

Prior to this phase of excavation, a program of soil sampling and laboratory analysis will be performed. Pre-excavation sampling/analysis is beneficial in that it further delineates the extent/volume of contaminated soil requiring excavation. Further, it eliminates the need to stockpile soil for characterization while awaiting disposal, where limited area for such activity is available. Storage space would likely be exhausted before disposal facility approval could be received and before soil could be transported off-Site to make room for newly excavated soil. Pre-excavation disposal characterization will eliminate multiple-step handling of soil and the cost of rapid laboratory turn-around of analytical results needed to expedite removal of stockpiled soil. Pre-excavation sampling will entail the use of a drill rig to advance soil borings to a typical depth of approximately 2 feet below original ground surface elevation. The pre-excavation soil boring program will also encompass sampling/analysis of contaminated soil beneath the asphalt pavement to be removed as part of Phase IV.

Disposal characterization samples will be analyzed, at a minimum, for ignitability, corrosivity, reactivity, VOCs, SVOCs, PCBs, TPH, RCRA metals, and herbicide. Because disposal characterization sampling will be performed in-place, costs assume that the excavated soil will be "live loaded" into dump trucks for transportation to the disposal facilities after laboratory analytical results are obtained. This translates to soil excavation of approximately 1,000 tons per day, or 50 dump trucks per day hauling 20 tons per load.

For the purpose of estimating disposal costs, it is assumed that the soil excavated as part of this phase will be disposed at a non-hazardous waste facility, such as a RCRA Subtitle D facility or thermal treatment facility.

Following Phase II excavation, samples will be collected from the base of the excavation area for laboratory analysis to confirm removal of soils exceeding cleanup levels. Confirmatory composite samples will, at a minimum, be analyzed for PCBs and total lead, which are the primary targets.

Phase III - Subsurface Soil Excavation: This phase will involve excavation of subsurface soils (i.e., generally 2 to 10 feet bgs) which exceed cleanup goals. These soils are generally located within discreet areas identified as the UST/AST, Lagoon, and SWRP 1 AST source areas.

As with the non-hot spot shallow soil, a program of pre-excavation soil sampling and laboratory analysis will be performed to both delineate the extent of contaminated subsurface soil requiring cleanup and to provide disposal characterization data. Soil sampling as part of this phase will entail the use of a drill rig to advance soil borings to a depth of approximately 10 feet below original ground surface elevation. Analytical results will drive delineation of the extent/volume of excavation. Disposal characterization samples will be, at a minimum, analyzed for ignitability, corrosivity, reactivity, VOCs, SVOCs, PCBs, TPH, RCRA metals, and herbicides.

For the purpose of estimating disposal costs, the following breakdown of contaminated subsurface soil volumes and disposal categories are presumed based on available data:

Location	Soil Contaminant/Disposal Category	Presumed Type of Treatment/Disposal Facility	Estimated Contaminated Soil Volume (cubic yards)
UST/ AST Area	PCBs 1 to 49 ppm, high lead	RCRA-hazardous	4,677
Lagoon Area	PCBs 1 to 49 ppm, high lead	RCRA-hazardous	5,258
SWRP 1 AST Area	PCBs < 1 ppm, low lead	Non-hazardous	1,637
		TOTAL SUBSURFACE SOILS:	**11,572**

Subsurface soil from the UST/AST and Lagoon areas will be disposed at a RCRA hazardous waste facility, while subsurface soil from the SWRP 1 AST area will be disposed at a RCRA Subtitle D facility, with approximately 50% of the volume suitable for daily cover at a correspondingly lower cost than that for the remaining 50% to be disposed of at the solid waste rate.

Because disposal characterization sampling will be performed in-place, costs assume the excavated soil will be "live loaded" into dump trucks for transportation to the disposal facilities after laboratory analytical results are obtained. Therefore, the rate of removal of the soil, and therefore the rate of excavation, will be limited to approximately 1,000 tons per day, or 50 dump trucks per day hauling 20 tons per load. This translates to approximately 18 working days to remove approximately 11,572 cubic yards (17,358 tons, assuming about 1.5 tons per cubic yard) of soil.

Following subsurface soil excavation, soil samples will be collected from the perimeter side walls of the excavations for laboratory analysis to confirm removal of soils exceeding cleanup levels. Laboratory analysis will, at a minimum, focus on PCBs and total lead, which are the primary targets.

Phase IV - Shallow Soil Excavation Below Asphalt Pavement: This phase involves removing the existing asphalt paved area around the newer Site building and excavating the underlying shallow contaminated soil (generally 0 to 2 feet bgs) for off-Site disposal. Although designated as the fourth phase of surface/shallow and subsurface soil remediation, this phase would likely be preceded by excavation of deeper soil contamination (i.e., greater than 2 feet bgs) and possibly the landfill, which would follow Phase III excavation activities described above. Prior to Phase

IV excavation, support equipment (e.g. office trailers, decon pads, truck scales) staged on the existing asphalt pavement during preceding remediation activities will need to be relocated to remediated or uncontaminated areas of the Site.

Based on available data, the estimated volume of contaminated shallow soil beneath the existing asphalt pavement of approximately 2,335 cubic yards is anticipated to generally contain PCBs at concentrations of 1 to 49 ppm, with relatively low lead concentrations (i.e. non-RCRA hazardous). For the purpose of estimating disposal costs, the soil excavated as part of this phase will be disposed at a non-hazardous RCRA Subtitle D facility. Asphalt and concrete pads removed prior to excavation will be disposed/recycled off-Site as non-hazardous demolition debris.

Because disposal characterization sampling of this area will have been performed as part of Phase II, excavated soil should be "live loaded" into dump trucks for transportation to the disposal facilities after laboratory analytical results are obtained. For cost purposes, the rate of removal of the soil, and therefore the rate of excavation, is limited to approximately 1,000 tons per day, or 50 dump trucks per day hauling 20 tons per load.

Following Phase IV excavation activities, samples will be collected from the base of the excavation area for laboratory analysis to confirm removal of soils exceeding cleanup levels. The confirmatory samples will, at a minimum, be analyzed for PCBs and lead, which are the primary targets.

Once all four phases are complete, excavation activities will focus on removing the contaminated soil piles.

Soil Pile Removal and Disposal: This measure will involve removal and off-Site disposal of seventeen soil piles present at the Site, which total approximately 16,000 cubic yards. Prior to removal, a field survey will be conducted to better define the soil pile volumes, which will help determine the number of samples required per pile for disposal profiling. After the volume survey, the soil pile tarpaulins will be temporarily removed to allow an excavator and sampling crew to perform sampling for disposal characterization. Disposal characterization samples will, at a minimum, be analyzed for ignitability, corrosivity, reactivity, VOCs, SVOCs, PCBs, TPH, RCRA metals, and herbicides.

For the purpose of estimating disposal costs, the following breakdown of soil pile volumes and disposal categories is presumed based on available data:

Soil Pile Nos.	Soil Contaminant/Disposal Category	Presumed Type of Treatment/Disposal Facility	Estimated Contaminated Soil Volume (cubic yards)

4, 11, 12, 13, NTCRA (NE)	PCBs < 1 ppm, low lead	Non-hazardous	2,374
3, 6, 8, 9, 10, 10A, NTCRA (SW)	PCBs 1 to 49 ppm, low lead	Non-hazardous	11,177
1, 2, 5A, 5B, 7	PCBs 1 to 49 ppm, high lead	RCRA-hazardous	2,454
		TOTAL SOIL PILES	**16,005**

Again, given the pre-excavation sampling and live loading into dump trucks is assumed for transportation to the disposal facilities after laboratory analytical results are obtained. Pile No. 9, however, will be screened to separate debris (i.e. solid waste, boulders, concrete, asphalt) from soil, prior to loading into trucks. Soil pile tarpaulin disposal, including disposal characterization sampling/analysis, will also be part of this measure.

Costs assume that the rate of removal of the soil piles will be limited to approximately 1,000 tons per day, or 50 dump trucks per day hauling 20 tons per load.

III. Excavate the On-Site Landfill Materials for Off-Site Treatment/Disposal

The selected remedy includes excavation of the on-Site landfill, separating and sorting of solid waste and soil fill to the extent practicable, dewatering the deepest material and off-Site disposal of solid waste and soil fill. The landfill material requiring excavation totals approximately 10,700 cubic yards.

The old Site building foundation constructed over the landfill is asphalt or concrete slab-on-grade with an average apparent thickness of up to approximately eight inches and an area of approximately 7,200 square feet. The demolished asphalt/concrete will be disposed/recycled as demolition debris.

Based on available data, the landfill materials have been grouped as follows:

- Debris/soil mixture (solid waste fill) in landfill located from 0 to 11 feet bgs to where the top of the LNAPL zone is generally encountered;
- Contaminated vadose zone soils below and in direct contact with the solid waste fill;
- Solid waste fill in LNAPL zone above the water table; and
- Solid waste fill and LNAPL zone soils (peat) below the water table.

Excavation Activities

Excavation of the landfill will begin with the removal of the mixture of solid waste fill generally located 0 to 11 feet bgs, down to where the top of the LNAPL zone is encountered. The solid waste fill will be screened on-Site to separate debris waste from soil to reduce the volume of the solid waste and associated disposal cost. Based on evaluation of test pit data obtained during the RI, the estimated volumes of debris and soil after screening are approximately 1,989 and 4,642 cubic yards, respectively. The screened debris and soil will be placed in separate temporary storage piles, underlain and covered with tarpaulins, for subsequent disposal characterization sampling/analysis.

Vadose zone soils below the bottom of the landfill, but above the LNAPL zone, which have been impacted by the landfill will also be excavated and separately stored for disposal characterization sampling/analysis. The estimated volume of vadose zone soils to be excavated is approximately 1,965 cubic yards.

Dewatering Activities

The solid waste fill within the LNAPL zone above the water table (approximately 2 feet thick located 11 to 13 feet bgs - approximately 1,169 cubic yards) will then be excavated and placed in a separate storage pile for disposal characterization sampling/analysis.

Below the water table, test pit logs from the RI indicate the presence of an approximately 2-foot thick contaminated peat layer which comprises the lower 2 feet of the LNAPL zone. The contaminated peat layer below the water table will be dewatered prior to disposal. Water will be allowed to drain back into the excavation from the bucket for subsequent treatment in the groundwater portion of the remedy, but the peat will likely retain a significant amount of water. The amount of water remaining in the excavated material prior to dewatering is estimated at 50% by volume.

Two options are proposed for managing and dewatering the LNAPL zone material excavated from below the water table. These options will also be applicable to dewatering of sediment excavated from Kelley Brook.

In the first option, the material would be placed on a drying bed of crushed stone with an underlying tarpaulin for collection of water. Water draining from the material onto the underlying tarpaulin would be pumped to frac tanks for characterization sampling and analysis prior to off-Site disposal. The area of the drying bed would be approximately 150 feet by 150 feet, with a 1-foot thick layer of crushed stone. This area would accommodate the approximately 1,169 cubic yards of excavated material from below the water table assuming it is piled to an average height of approximately 2 feet.

In the second option for dewatering, excavated material would be loaded directly into roll-off filter containers. Water draining from the material would pass through a filter cloth and screen at the bottom of the container and be pumped to frac tanks for characterization sampling and analysis prior to off-Site disposal. A vacuum truck hose could be connected to the bottom of the containers to assist in dewatering the material and transferring the water to the frac tanks.

The appropriate option for dewatering will be selected by during the design. Regardless of which option is selected, the water may require pre-treatment prior to offsite disposal at a POTW or will be sent to a hazardous waste facility for disposal.

Disposal Activities

Disposal of landfill materials and water will require disposal characterization sampling and analysis. Disposal characterization samples will, at a minimum, be analyzed for ignitability, corrosivity, reactivity, VOCs, SVOCs, PCBs, TPH, RCRA metals, and herbicides.

For the purpose of estimating disposal costs, a breakdown of landfill material and dewatered volumes and disposal categories is summarized as follows based on available data:

Landfill Material Group/Location	Soil Contaminant/Disposal Category	Presumed Type of Treatment/Disposal Facility	Estimated Contaminated Soil/Water Volume (cubic yards/gallons)
Solid Waste in Landfill above LNAPL Zone	PCBs 1 to 49 ppm, low lead	Non-hazardous	1,989
Soil in Landfill above LNAPL Zone	PCBs 1 to 49 ppm, low lead	Non-hazardous	4,642
LNAPL Zone Soil and Solid Waste above Water Table	PCBs 1 to 49 ppm, high lead	RCRA-hazardous	1,169
LNAPL Zone Soil below Water Table	PCBs 1 to 49 ppm, high lead	RCRA-hazardous	936 (after dewatering)
Vadose Zone Soil below Landfill	PCBs 1 to 49 ppm, low lead	Non-hazardous	1,965
Frac tank water	PCBs 1 to 49 ppm, VOCs	Offsite POTW	118,000 gals.
		TOTAL Estimated Landfill Volume:	**10,701 cubic yards and 118,000 gallons**

IV. <u>Excavate Contaminated Kelley Brook Sediment for Off-Site Treatment/Disposal</u>

The selected remedy includes active remediation involving a limited sediment excavation program. The contaminated sediment requiring excavation is generally located between the existing oil interceptor trench and Kelley Brook. Refer to Figure 1.3. The volume of sediment considered for excavation is approximately 150 feet long, 50 feet wide, and 4 feet deep (approximately 1,110 cubic yards [in place]). A secondary area of sediment, located about 150 feet down stream from the sediment area described above, contains elevated concentrations of contaminants above cleanup levels. Unlike the larger area described above which is heavily contaminated and poses unacceptable site risks, this area of sediment will not be removed since EPA has determined that greater impacts would occur from disturbing this area of sediments. This evaluation is attached as Appendix C. However, Kelley Brook sediments will be monitored post excavation to ensure contaminant levels are attenuating once the source sediment is removed.

Pre-Excavation Sediment Sampling and Analysis

To confirm the limits of sediment excavation, a pre-excavation sediment sampling and analysis program will occur as part of this alternative. Based on observed contaminant distribution and the results of the Ecological Risk Assessment, sediment samples will, at a minimum, be analyzed for PCBs, PHCs, arsenic, cadmium, iron, lead, mercury, and molybdenum. The sampling grid and final sampling locations will be surveyed, and a sediment sampling report will be prepared.

Site Clearing specifically for Sediment Excavation

The sediment excavation area contains heavy brush, small trees, and is also wet. Clearing of brush and construction of an access roadway will likely be necessary to allow equipment to access the area. A temporary access roadway will be constructed on top of a berm built along three sides of the planned excavation area. The fourth side, which is parallel and adjacent to the existing oil interceptor trench, appears to be accessible without further modifications, once the existing Site fence is removed. The berm will be constructed of an approximately two-foot thick gravel base overlain by geotextile/drainage fabric and approximately 1 foot of crushed stone. The top of the berm will be approximately ten to fifteen feet wide to allow construction equipment to drive along the perimeter of the excavation area.

After the berm is constructed, sheet piling will be driven on all four sides of the sediment excavation area (400 foot perimeter) to limit inflow of surface water and groundwater, and limit transport of contaminated sediment into the Kelley Brook wetlands.

Sediment Excavation and Dewatering

Sediment excavation shall be accomplished by using a 1.5-cubic-yard clamshell excavator with a 60-foot boom, or similar equipment. The excavator will move along the perimeter berm and reach into the excavation area to dig out the sediment. Water will drain as much as practicable back into the excavation from the sediment in the clamshell bucket for subsequent treatment under the groundwater portion of the remedy, but the sediment will likely retain a significant amount of water. The amount of water remaining in the excavated sediment prior to dewatering is estimated at 50% by volume.

Following excavation of contaminated sediment, confirmatory sampling and analysis is required. The samples will, at a minimum, be analyzed for the same suite of parameters as listed above as part of pre-excavation sampling/analysis. The same two options for dewatering and managing the LNAPL material excavated from below the water table outlined above will be evaluated for managing and dewatering these sediments.

Conservatively, the volumes of dewatered sediment and water requiring disposal are estimated to be approximately 890 cubic yards and 110,000 gallons, respectively.

Disposal of Dewatered Sediment and Water

Disposal of dewatered sediment and water will require disposal characterization sampling and analysis. Sediment disposal characterization samples will, at a minimum, be analyzed for ignitability, corrosivity, reactivity, VOCs, SVOCs, PCBs, TPH, RCRA metals and herbicides.

For the purpose of estimating disposal costs, the dewatered sediment is presumed to be non-hazardous and contain PCBs in the concentration range of 1 to 49 ppm (i.e, TSCA-hazardous), with relatively low lead concentrations (i.e. < 400 ppm); therefore, dewatered sediment will be sent to a RCRA Subtitle D facility. Frac tank water will be sent to an offsite POTW; onsite pretreatment may be necessary.

Long-term Monitoring of Sediment/Surface Water

Long-term monitoring of sediment and surface water in Kelley Brook will consist of annual sampling and analysis. Surface water samples will be analyzed for VOCs, PAHs, and metals. Sediment samples will be analyzed for VOCs, PAHs, PCBs, and metals. The sampling locations will generally coincide with a subset of the sediment/surface water sampling locations used for the RI.

V. <u>Restore Kelley Brook Wetlands in the Landfill and Sediment Excavation Areas</u>

Because the landfill and sediment excavation areas occurred in wetlands, restoration activities are necessary.

Pre-Design Investigation

Prior to excavation activities, further characterization of the existing adjoining wetlands will be performed to provide baseline information for developing design criteria for wetlands restoration. Characterization will include information about soils, vegetation, and hydrology. A wetland functional assessment will be conducted to assess the existing functions and values of the wetland. The success of the wetlands restoration will likely depend in part on a design which ties in the restored wetlands area with the existing hydrology of Kelley Brook. Pre-design/design investigation activities will be focused on obtaining the data needed to achieve this goal.

Wetlands Restoration Conceptual Design

Restoration of wetlands within the landfill and sediment excavation areas adjoining Kelley Brook will be accomplished by post-excavation grading, importing wetlands soils, planting wetlands vegetation, and modifying surface water flow patterns so that the restored area receives adequate water. The access roadway berm could largely remain in place, however, a channel/culvert will be excavated through the berm to connect Kelley Brook with the restored area to allow for flow of water into and out of the wetlands. Prior to constructing the channel/culvert through the berm, approximately two feet of imported wetlands soil will be placed in the bottom of the excavation and the area will be planted with wetlands vegetation. Sheet piling installed in association with sediment excavation activities will assist in surface water management during wetlands restoration activities, and must ultimately be removed.

Based on plant species observed within the existing Kelley Brook wetland, the primary vegetation proposed for the restoration area will include red maple (Acer rubrum), speckled alder (Alnus rugosa), black willow (Salix nigra), silky dogwood (Cornus amomum), and winterberry (Itex verticillata). Gradual natural revegetation of the area by emergent and fern species will also likely occur. Such species include cattails (Typha latifolia), cinnamon fern (Osmunda cinnamonea), royal fern (Osmunda regalis), and sensitive fern (Onoclea sensibilis).

Wetlands Restoration Monitoring

Monitoring of restored wetlands will involve annual inspections for five years, most likely in the spring, to assess plant hardiness and mortality. If plant mortality exceeds a certain percentage (typically 25%), supplemental plantings and/or other modifications to the restoration area would need to be performed.

Post-Excavation Activities

Post-excavation activities for Site restoration primarily consist of backfilling and grading excavated areas with clean, imported fill, placement of approximately 6 inches of topsoil, and seeding. Grading will accommodate planned uses of the property to the extent practical. Trees will be planted along the western border of parcel 1 to replace vegetation removed during earlier clearing and grubbing activities. The tree species will be consistent with the general area (i.e., maple, oak or pine). Existing depressions in Site topography associated with SWRP 1, SWRP 2, and the AST containment structure will be filled-in with on-Site or imported fill and finished with topsoil and seeding. Non-wetland areas of the landfill excavation will also be backfilled.

Uncontaminated Site soil excavated to access contaminated deep soil, which totals approximately 65,500 cubic yards temporarily stored on Parcel 2, will be placed back in the excavated areas at the completion of deep soil remediation activities. The estimated backfill volumes associated with the various excavation areas/categories are summarized below:

General Soil Area/Location	Estimated Imported Backfill Volume (cubic yards)	Estimated Topsoil Volume (cubic yards)	Backfill from Uncontaminated Site soil (cubic yards)
Surface/shallow (0 to 2 feet bgs) and subsurface soils (2 to 10 feet bgs)	42,000	9,400	0
SWRP 1, SWRP 2, and AST containment depressions	11,400	Included above	0
Deeper soil (replacement of contaminated UST/AST/SWRP 2 area and Lagoon area soil)	50,000	Included above	0
Uncontaminated soil overlying contaminated deeper soil	0	Included above	65,500
Landfill (non-wetland area)	4,000	300	0
TOTALS:	**107,400**	**9,700**	**65,500**

Site restoration will also include approximately 30,000 square feet of asphalt re-pavement around the newer Site building, replacement of Site fencing removed during excavation, and replacement of monitoring wells, as determined necessary.

VI. Install Management of Migration Alternative MOM-3 (Groundwater Collection and Treatment - Higher Pumping Rate)

The selected remedy for management of migration will protect human health and the environment through groundwater collection and treatment (at an assumed extraction rate of 200 gpm) in the vicinity of source areas and receptors and natural attenuation for selected less-contaminated areas of the groundwater plumes.

Note that pre-design studies, as outlined above, will be performed to determine final design parameters for the extraction system, treatment processes and effluent discharge. Consequently, the final extraction system, treatment processes and/or effluent discharge may vary from the following conceptual design, however the primary goal remains to restore the aquifer beneath the Site to drinking water standards within approximately 15 years, and restore drinking water quality to existing impacted well users within approximately 5 years.

Conceptual Design of Groundwater Collection and Treatment System

The conceptual design of the groundwater collection and treatment system consists of the following principal subsystems:

1. Groundwater Extraction System;
2. Groundwater Treatment System; and
3. Treated Groundwater Discharge System.

Each of these components is discussed below.

1. Groundwater Extraction System

The groundwater extraction system conceptual design is based on the results of a groundwater flow modeling study for the Site. The results indicate that extraction from a combination of wells located near the source areas on Parcel 1 and near the residential water supply wells located southeast of Parcel 2 will most effectively capture the groundwater plumes and reduce groundwater cleanup times.

The conceptual design includes the installation of five extraction wells on Parcel 1 and two extraction wells on Parcel 2. The wells on Parcel 1 are referred to as the "near source" extraction wells, and their purpose is to capture contaminant plumes while they are still close to their sources and relatively shallow. The wells on Parcel 2 are referred to as the "near receptor" extraction wells, and their purpose is to capture contaminated groundwater upgradient of affected residential water supply wells located southeast of Parcel 2 and decrease the length of time that these residential wells remain contaminated. A layout of the conceptual system is depicted on Attached Figure 4.9. The final number and placement of the extraction wells will be determined by EPA, after review and comment by DES, based on data collected and additional modeling performed as part of the pre-design study.

A combined minimum extraction rate of 200 gpm is assumed for the conceptual design to incorporate a safety factor as an allowance for uncertainty in formation hydraulic conductivity, potential effects of contaminant desorption and dispersion, and other variables. The final groundwater flow rate will be determined by EPA, after review and comment by DES, based on data collected and additional modeling performed as part of the pre-design study.

Each extraction well will be equipped with an electrical submersible pump and instrumentation, such as a pressure gauge, water level transducer, and flow meter. The wellheads will be completed in a below grade vault or above grade enclosure. The extraction wells will be piped to the groundwater treatment system via underground piping.

2. *Groundwater Treatment System*

The purpose of the groundwater treatment system is to reduce contaminant concentrations in the extracted groundwater to levels which are suitable for discharge. Treated groundwater will be discharged either to Kelley Brook or returned to the subsurface upgradient of the source areas via a subsurface infiltration system. Final selection of either surface water or groundwater discharge will occur as part of final design and will depend in part on the discharge concentration limits established for each method.

The conceptual design of the groundwater treatment system consists of flow/contaminant concentration equalization, removal of metals such as iron by chemical precipitation, and removal of VOCs (and other organic compounds) by air stripping and activated carbon adsorption.

Because the subsurface soil has become saturated with the LNAPL oil, a residual amount of oil will remain in the soil after the LNAPL system has been discontinued. Therefore, oil/water separation is a component of the groundwater treatment system, particularly during in-situ remediation of deeper soils using steam injection as part of the source control remedy. Measures will need to be taken to prevent oil from entering the groundwater treatment system. Oil detection probes will be installed in the extraction wells to prevent pumping of oil by the groundwater extraction pumps. Oil entering the extraction wells will be removed by separate oil pumps or vacuum extraction equipment and will be disposed of offsite.

The initial treatment steps will focus on the removal of metals such as iron. Influent metals such as iron are expected to be present in extracted groundwater at significantly elevated concentrations compared to background levels. Certain metals would cause fouling and loss of efficiency of treatment equipment for VOC removal (i.e. air strippers and activated carbon), and they could potentially foul a subsurface discharge system.

Extracted groundwater will then enter an equalization/pre-aeration tank. The equalization/pre-aeration tank will provide adequate storage volume to dampen variations in well pumping rates and contaminant concentrations entering the system, allow for partial oxidation of metals, and accept recycle flows from downstream unit processes for further treatment (e.g. sand filter backwash, sludge dewatering water.) Air for tank mixing and oxidation of metals will be provided by blowers.

Following equalization/pre-aeration, groundwater will enter a reaction tank where its pH will be raised to facilitate precipitation of metals. Sodium hydroxide will be added to the reaction tank to increase pH, and polymer will be added to promote agglomeration of precipitates and production of particles amenable to gravity settling. The reaction tank will be continuously and rapidly mixed using a propeller-type mixer.

After pH adjustment and polymer addition, the groundwater will enter a flocculation (slow mix) tank followed by a parallel plate clarifier. The flocculation tank will be gently mixed to promote the formation of larger precipitates. The clarifier will provide quiescent conditions to allow for gravity settling of precipitated metals. Precipitated and settled metals will be drawn off the bottom of the clarifier and conveyed to a sludge dewatering system. The sludge dewatering system is further described below. Clarified groundwater will pass over an overflow weir and continue to the sand filter system.

The purpose of the sand filter system will be to remove finer particulates not removed by clarification, and hence further reduce metals concentrations and limit the potential for fouling of the downstream air strippers, carbon adsorption equipment, and subsurface infiltration system. The sand filter system will be comprised of continuous backwash filter units, which unlike conventional pressure filters, do not require periodic shut down for backwashing. Water for filter backwashing will be obtained from the final effluent of the groundwater treatment system. Dirty backwash water will be returned to the equalization/pre-aeration tank.

After filtration, groundwater will undergo a second pH adjustment step to reduce the pH of the groundwater to a level suitable for discharge. Sulfuric acid will be added to a continuously mixed reaction tank to lower the pH of the groundwater prior to being conveyed to the air stripping system.

To limit fugitive emissions of VOCs during equalization and metals precipitation, each of the tanks associated with these processes will be covered and vented to the vapor-phase carbon adsorption system used to control emissions from the subsequent air stripping process. Further description of the emissions control system is given below.

The objective of the air stripping system will be to reduce the levels of VOCs in the extracted groundwater to concentrations equal to or below their respective AGQS/MCL concentrations. The final design parameters for the air stripping system will be determined by EPA, after review and comment by DES, based on data collected and additional modeling performed as part of the pre-design study.

VOC emissions from the air strippers will be vented to a vapor-phase carbon emissions control system. The carbon units will also treat fugitive VOCs captured from preceding process equipment. Because of the anticipated VOC mass loading onto the carbon, on-Site steam regeneration of the carbon may be incorporated into the system rather than off-Site reactivation/disposal and replacement of carbon. A boiler would be provided to furnish steam for on-Site carbon regeneration. VOC-containing steam would be condensed and separated. Separate phase VOCs would be disposed off-Site as a hazardous waste liquid. VOCs which remain dissolved in the condensed aqueous phase would be recycled to the equalization/pre-aeration tank.

To achieve additional reductions in VOC concentrations and lower SVOC concentrations following air stripping, groundwater will undergo polishing treatment by liquid-phase activated carbon adsorption. Following carbon polishing, the treated groundwater will enter an effluent tank for subsequent transfer to the final discharge location. Treated groundwater from the effluent tank will also be used for other purposes, including sand filter backwash feedwater and boiler feedwater used to supply steam if on-Site regeneration of vapor-phase carbon is performed, or if steam injection is performed in conjunction with the in-situ SVE.

The groundwater treatment system will also include sludge dewatering equipment. Sludge will be generated as a result of the metals precipitation step. Sludge from the metals precipitation step will be transferred from the clarifier bottom to sludge holding/conditioning tanks. Quicklime (CaO) may be added and mixed with the sludge in the holding/conditioning tanks to enhance its dewatering properties. The conditioned sludge will then be pumped to a recessed-plate filter press where water will be squeezed out of the sludge under high pressure. Water, or filtrate, removed from the sludge will be returned to the equalization/pre-aeration tank. The thickened and dried sludge, or sludge cake, will be transferred to a roll-off container for off-Site disposal. Testing will be conducted as part of pre-design investigations to assess the potential for generating sludge which must be disposed of as hazardous waste, as well as to evaluate sizing parameters for sludge dewatering equipment.

3. *Treated Groundwater Discharge System*

Treated groundwater will be discharged to the subsurface upgradient of the contaminant source areas via a subsurface infiltration system. The location for subsurface discharge is limited to the wooded western portion of Parcel 1 which is upgradient of the Site plume. Discharge elsewhere on Parcel 1 or Parcel 2 would be too close to contaminant source areas and/or would disturb groundwater plume vertical and horizontal migration pathways (e.g., cause plume to migrate deeper into overburden/bedrock).

The conceptually designed groundwater discharge system will consist of large diameter, vertical infiltration wells installed hydraulically upgradient of the contaminant source areas in the western portion of Parcel 1. The infiltration wells will not be injection wells; instead, groundwater piped to the wells will passively infiltrate into the subsurface under the force of gravity only.

Treated groundwater will be conveyed to the infiltration well field from the treatment plant via underground header piping, and then distributed to the wells via underground laterals. The distribution piping elevations and connections to the wells will be hydraulically designed to balance the flows to the wells under gravity flow conditions. Valves will be provided at the wells to help regulate and balance the flow to each well. In the event the flow to a well is greater than it can accommodate, the overflow will back up into the distribution piping network and flow into another well. Final selection and design of the groundwater discharge system will be based on pre-design studies, including consideration of the discharge flow rate.

Groundwater Monitoring Requirements

A comprehensive monitoring program will be performed to evaluate changes to the plume and measure the effectiveness/success of the source control and management of migration remedies. Monitoring well samples are to be collected using the low-flow technique. Samples are to be analyzed, at a minimum, for VOCs and other COCs. The actual number, frequency, parameters and sampling and analytical methods for the groundwater monitoring program will be determined by EPA, after review and comment by DES, during the pre-design phase.

Residential Monitoring Requirements

A comprehensive residential monitoring program will be performed to ensure the continued quality of drinking water in off-Site supply wells and the continued effectiveness of the POE treatment units. Currently, between 10 to 20 residential supply wells are sampled quarterly. A more comprehensive round of about 60 residential supply wells ringing the Site are sampled every three years. Samples are analyzed for VOCs and natural attenuation parameters. The actual number, frequency, parameters and sampling and analytical methods for the residential monitoring program will be determined by EPA, after review and comment by DES, during the pre-design phase.

In addition, monitoring of air quality in structures within the vicinity of the Site for excess vapors will be conducted when EPA determines it is appropriate. If unsafe levels are found, mitigation measure will be required as necessary.

Natural Attenuation of Selected Source Areas/Contaminated Groundwater Plumes

Natural attenuation of selected source areas/contaminated groundwater plumes is a component of the selected remedy. These source areas/plumes include the solvent distillation unit source/plume, SWRP 1 source/plume and that portion of the UST/AST/SWRP 2 plume which discharges to Kelley Brook. Clean up goals will be attained in 15 years consistent with the active pumping portion of the remedy.

VII. <u>Perform In-Situ Treatment of Deep Soil Using Soil Vapor Extraction (SVE)</u>

As part of the source control portion of the remedy, active remediation of deep soil (i.e., soil contaminants greater than 10 feet bgs) using in-situ soil vapor extraction (SVE) is required. The purpose of active remediation of deep soil contamination is to address VOCs which are acting as a continuing source of groundwater contamination. SVE will remove VOCs, and some SVOCs, from deep soil by inducing air flow through contaminated soil zones, mass transfer of these contaminants to the vapor phase, and extraction of vapors via vertical wells connected to a vacuum blower.

Conceptual Design of the SVE System

The conceptual SVE system consists of 100 4-inch diameter vacuum extraction wells, including about 70 vacuum wells installed at the centers of a 50-foot by 50-foot grid over an approximate 4-acre area, with an additional 30 vacuum wells installed around the perimeter to maintain vapor flow toward the clean-up area. Wells will typically be screened over a 10-foot interval from 15 to 25 feet bgs. The construction material for the wells and associated piping (i.e., PVC or steel) will be determined following conclusion of the thermal-enhancement treatability study. Additional soil samples may be collected during the design phase to more accurately define the extent and depth of soil requiring treatment.

The SVE wells will be connected to the vacuum blower system via above ground piping (PVC or steel.) The vacuum blower system will consist of positive displacement-type vacuum blowers located in an equipment enclosure.

The conceptual layout of the SVE system, with steam injection, is shown in the attached Figure 4.4. The final design of the SVE system will be made by EPA, in its sole discretion, and after consideration of DES review and comment.

Vapor Emissions Controls

Vapor-phase activated carbon will be used for control of VOC emissions from the SVE system. Activated carbon vessels will be replaced as necessary and spent carbon vessels will be sent offsite for recycling or disposal as appropriate. If thermal-enhancement of the SVE system via steam injection is deemed necessary, activated carbon vessels may be regenerated on-Site. VOC-laden steam resulting from carbon regeneration will be condensed and separated. Separate-phase liquid VOCs will be disposed off-Site as a hazardous waste. Condensed water containing dissolved VOCs will be pumped to the on-Site groundwater treatment system.

Water Table Depression (Groundwater Extraction) and Treatment System

Because the LNAPL zone extends 8 to 10 feet or more below the ambient water table in some Site locations, installation and operation of a water table depression system via groundwater extraction is necessary. Although some lowering of the water table will occur due to the operation of the groundwater extraction and treatment system for groundwater restoration, groundwater modeling performed during the FS suggests that additional groundwater extraction will be necessary to achieve adequate dewatering of the LNAPL zone beneath the UST/AST and Lagoon source areas on Parcel 1.

The conceptual design of the SVE system includes the installation of 5 additional extraction wells, beyond those included for groundwater restoration, specifically for water table depression. The need for additional extraction wells will be determined during pre-design studies. Extracted groundwater will be treated using the onsite groundwater treatment system, described below. These wells will be turned off at the completion of the in-situ treatment of deep soil.

Thermal-Enhancement Through Steam Injection

Because VOCs are primarily present in waste oil located in the deeper vadose and smear zone soils, thermal-enhancement of the SVE system using steam injection may be required as part of this alternative. The addition of heat and the resulting increase in subsurface temperature would lead to a considerable increase in contaminant recovery rate, which in turn could result in a significant reduction of cleanup time frame as compared to non-thermally-enhanced SVE. Raising the temperature of the subsurface increases the removal rate of organic contaminants due to the following thermodynamic changes:

- the volatility (vapor pressure and Henry's law constant) increases with increasing temperature;
- NAPL, aqueous, and gaseous phase diffusion coefficients increase with increasing temperature;
- contaminant adsorption to soil particles is reduced at higher temperatures; and
- for residual waste oil, viscosity and interfacial tension decrease with increasing temperature, which can lead to enhanced recovery of the organic contaminants within the oil.

Several methods have been established and implemented to increase subsurface temperature, including steam injection, hot water injection, hot air injection, and electrical heating (both power line frequency and radio frequency). If thermal-enhancement is deemed necessary, steam injection is preferred because of the following advantages:

- Steam injection is the lowest cost method for delivering energy to the subsurface. Approximately 90% of the energy content of the fuel used to produce steam is delivered to the subsurface. By contrast, typically less than 50% of the energy required to generate electricity for electrical heating methods is delivered to the subsurface.
- Steam injection is capable of a higher energy input rate to the subsurface than other subsurface heating methods. As a result, subsurface heating occurs faster leading to potentially faster cleanup time.

The final decision regarding the use of steam injection will be made by EPA, in its sole discretion, after review and comment by DES, based in part on results of a pre-design treatability study described above. The current cost estimate for the source control portion of the remedy conservatively includes the application of thermal-enhancement via steam injection based on the conceptual system described below.

Conceptual Design of Steam Injection for Thermally-Enhanced SVE

The conceptual design for the steam injection system will consist of injection wells installed over the areal extent of deep soil contamination. This area is approximately 4 acres, as estimated in the RI, and is assumed to coincide with the Lagoon and UST/AST/SWRP 2 source area smear zones, including the smear zone within the landfill.

As conceptually designed, approximately 70 2-inch diameter steam injection wells would be installed on a 50-foot by 50-foot grid pattern over the 4-acre area. An additional 30 or so wells would be installed directly below the Lagoon and AST/UST/SWRP 2 source areas extending over approximately 1 acre. The total steam injection rate is estimated to be 15,000 pounds per hour (lbs/hr). The final design parameters for the steam injection wells, including the number of wells, well layout, screened interval, and steam injection rate and pressure will be assessed by field pilot testing as part of the pre-design investigations.

The steam injection wells will be connected to a steam boiler system via a network of aboveground, insulated, steel distribution piping. The boiler(s) will also be used to provide steam for on-Site steam desorption of the vapor-phase activated carbon associated with SVE emissions controls as further described below.

The utilities required to operate the steam boiler system will include fuel, water, and electricity. An aboveground, steel tank with secondary containment and leak detection will be provided for fuel oil storage.

Confirmatory Assessment and SVE System Decommissioning

To confirm clean-up of deep soil contamination, soil samples will be collected when contaminant mass removal by the SVE system approaches a low, relatively asymptotic rate as compared to removal rates attained over the operational period of the system. Confirmatory sampling will include the collection of continuous soil samples beginning at 10 feet bgs, or from above the LNAPL zone interface, proceeding to the bottom of the LNAPL zone. Samples will be submitted for laboratory analysis.

VIII. Obtain Institutional Controls

Soil - Consistent with the source control component of the remedy, impacted areas of soil contamination throughout the Site will be remediated to a depth 10 feet below ground surface, which will allow for unrestricted residential use. However, because contaminants other than VOCs remain below 10 feet and because the State of New Hampshire considers soils to a depth of 15 feet below ground surface to be "potentially accessible," activity and use restrictions (AURs) will be placed on Parcel 1 of the Site to prevent future excavations below a depth of 10 feet. No deep soil contamination is present on Parcel 2. The AURs established for Parcel 1 will be permanent unless additional remedial actions, which are beyond the scope of this ROD, are undertaken to address soil contamination below 10 feet.

Groundwater - Consistent with the management of migration portion of the remedy, groundwater contamination located within the aquifer beneath the Site will be remediated through an on-Site extraction and treatment system. Institutional controls to prevent exposure to contaminated groundwater are necessary since aquifer restoration will require an estimated 15 years to attain. A Groundwater Management Zone (GMZ), as defined by the State of New Hampshire (Env-Wm 1403), will be established to prevent the installation of new groundwater supply wells by placing restrictions or notifications on the deeds of properties located within the plume area. Delineation of the GMZ is depicted on attached Figure 4.1. Since an alternative water supply is not available, the use of point of entry (POE) treatment systems will continue to ensure the availability of potable water to impacted users.

Kelley Brook

Until such time as contaminant levels in fish tissue reach safe levels, the remedy will include institutional controls such as no fishing signs and education campaigns to minimize ingestion of fish. Currently a state fish advisory is in place cautioning about consumption of fish.

3. Five Year Reviews

Since hazardous materials will remain in groundwater and deeper soil for more than five years from the initiation of the selected remedy, EPA will review the Site at least once every five years after the initiation of remedial action to assure that the remedial action continues to protect human health and the environment. EPA will also review the Site prior to eventual deletion from the National Priorities List which essentially ends Superfund involvement at the Site.

4. Summary of the Estimated Remedy Costs

The following tables summarize the major capital and annual operation and maintenance (O&M) costs for the overall remedy (SC-5 and MOM-3 respectively). These costs are based on information collected during the RI/FS to develop a conceptual remedy and are therefore expected to be accurate only to a margin of +50% to -30%. O&M costs are reported as net present worth estimates based on a discount rate of 7% (per EPA policy) over a period of 15 years. Given the scope and complexity of this remedy, actual costs will be somewhat different. For complete detailed descriptions of the assumptions and components used to estimate the remedy costs, refer to Appendix E for SC-5 and Appendix F for MOM-3 of the FS Report.

SC-5 Cost Summary

Description	Cost	Notes
Site Preparation/Facilities	$1,223,357	Includes NTCRA decommission
Soil Pile Removal/Disposal	$1,967,660	estimated 24,008 tons
Surface/Shallow Soil Removal/Disposal Phase I (PCBs > 50 ppm)	$1,069,777	estimated 1,968 tons
Surface/Shallow Soil Removal/Disposal Phase II (PCBs < 50 ppm)	$3,283,821	estimated 53,255 tons
Sub-Surface Soil Removal/Disposal Phase III	$3,044,958	estimated 17,359 tons
Removal/Disposal of Soil Below Asphalt Phase IV	$229,866	estimated 3,503 tons
Post-Excavation Tasks	$1,222,879	Backfill/grade
Sediment/Landfill Removal/Disposal	$2,487,767	estimated 17,088 tons Includes wetland restoration
Construction of SVE System (Thermally-Enhanced)	$2,022,645	
Total Estimated Capital Cost	**$25,760,480**	Includes 15% contingency
Total Operation and Maintenance Costs (Years 1 and 2)	$6,360,033	
Total Operation and Maintenance Costs (Years 3 through 5)	$79,460	
Total Operation and Maintenance Costs (Years 6 through 30)	$131,438	
Total Periodic Costs	$792,051	Includes SVE decommission, sediment monitoring and 5-yr reviews
Total Estimated Net Present Worth Cost	**$33,123,462**	Assumes 7% discount rate, Includes Project Management and 15% contingency

MOM-3 Cost Summary

Description	Cost	Notes
Installation of 1 POE Unit and Replacement of 6 Residential Supply Wells	$179,121	6 bedrock wells
Site Preparation/Facilities	$452,920	
Construction of Groundwater Extraction, Treatment and Infiltration System	$2,979,126	
Institutional Controls/AURs	$86,376	GMZ and deed restrictions
Total Estimated Capital Cost	**$6,142,303**	Includes 15% contingency
Total Operation and Maintenance Costs (Years 1 through 15)	$8,406,430	
Total Periodic Costs	$484,513	Includes treatment system decommission, well closures and 5-yr reviews
Total Estimated Net Present Worth Cost	**$15,033,246**	Assumes 7% discount rate, Includes Project Management and 15% contingency

Preferred Remedy Cost Summary

Description	Cost	Notes
Total Estimated Capital Cost	**$31,902,783**	Includes 15% contingency
Total Estimated Net Present Worth Cost	**$48,156,708**	Assumes 7% discount rate, Includes Project Management and 15% contingency

The information in these cost estimate summary tables are based on the best available information regarding the anticipated scope of the remedial alternative.

5. Expected Outcomes of the Selected Remedy

The primary expected outcome of the selected remedy is that the entire 40 acre Site, including soils on Parcels 1 and 2, sediments from Kelley Brook and the groundwater aquifer beneath the Site, will no longer present an unacceptable risk to current and future residents, trespassers, waders, construction workers or fisher persons via direct contact with and/or ingestion of soil, sediment or groundwater or consumption of fish and will be suitable for unrestricted residential use of the entire Site. Approximately 4 to 5 years are estimated as the amount of time necessary to complete soil and sediment remediation activities and achieve the stated soil cleanup levels consistent with residential use of the property down to 10 feet.

Another expected outcome of the selected remedy is that the groundwater aquifer beneath and extending off-Site will not present an unacceptable risk to current and future resident users and will be suitable as a drinking water supply. Approximately 15 years of treatment are estimated as the amount of time necessary to achieve the stated groundwater cleanup levels consistent with restoration of the aquifer to drinking water standards. Approximately 5 years of treatment are estimated to be necessary in order to restore drinking water quality to currently impacted off-Site residential supply wells.

To the extent that future property use on-Site and in the vicinity of the Site involves construction of buildings on the property (i.e., homes or a community center) prior to completion of groundwater remedial activities, risks to human receptors associated with a potential vapor intrusion pathway from the remaining VOC plume will need to be evaluated. A quantitative evaluation consistent with EPA's "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, November 2002" will be necessary to demonstrate that vapors from soil and/or groundwater do not pose an unacceptable risk via the inhalation pathway. If unsafe levels are detected, mitigative measures will be taken.

The selected remedy will also provide environmental and ecological benefits such as improvement to surface water quality in Kelley Brook and restoration of the associated wetland areas. It is anticipated that the selected remedy will also provide socio-economic and community revitalization impacts such as increased property values, improved neighborhood aesthetics, preserved open space, new recreational fields and desired retirement housing.

6. Cleanup Levels

Interim Groundwater Cleanup Levels

Interim cleanup levels have been established in groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. Interim cleanup levels have been set based on the ARARs (e.g., MCLs, and more stringent State of New Hampshire AGQSs) as available, or other suitable criteria described below. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action.

At the time that Interim Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on all residual groundwater contamination to determine whether the remedial action is protective. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by all detected chemicals (including but not limited to the chemicals of concern) via ingestion and direct contact of groundwater and inhalation of groundwater vapors (i.e., bathing). If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until either protective levels are achieved, and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective or is modified. These protective residual levels shall constitute the Final Groundwater Cleanup Levels for this ROD and shall be considered performance standards for this remedial action.

The New Hampshire Department of Environmental Services completed a Groundwater Use and Value Determination on the Town of Plaistow aquifer above which the Beede Waste Oil Site is located. This determination is attached as Appendix D. This finding indicates that the groundwater aquifer beneath the Site is of "**High Value"** since it is currently, and is projected to remain, the only source of drinking water for the Town of Plaistow. Drinking water standards, consistent with this use and value determination, must be attained in the groundwater at the Site.

Interim cleanup levels for known, probable, and possible carcinogenic chemicals of concern (Classes A, B, and C) have been established to protect against potential carcinogenic effects and to conform with ARARs. Maximum Contaminant Levels and the more stringent AGQSs have been selected as the interim cleanup levels for these Classes of chemicals of concern.

Interim cleanup levels for Class D and E chemicals of concern (not classified, and no evidence of carcinogenicity) have been established to protect against potential non-carcinogenic effects and are set at MCL and more stringent AGQSs.

The following Table summarizes the Interim Cleanup Levels for carcinogenic and non-carcinogenic chemicals of concern identified in groundwater.

Interim Groundwater Cleanup Levels				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Interim Cleanup Level (ug/l or ppb)**	**Basis**	**RME Risk**
Alkylbenzenes	varies	50	AGQS	no toxicity value
Arsenic	A	10	MCL	2.30E-04
Benzene	A	5	MCL	4.22E-06
1,2 Dichloroethane	B2	5	MCL	6.98E-06
Methylene Chloride	B2	5	MCL	5.75E-07
1,1,2,2 Tetrachloroethane	C	0.17	AGQS	5.22E-07
Trichloroethene	n/a	5	MCL	8.44E-07
Vinyl Chloride	A	2	MCL	4.60E-05

Non-Carcinogenic Compounds of Concern	**Target Endpoint**	**Interim Cleanup Level (ug/l or ppb)**	**Basis**	**RME Risk**
Antimony	blood, chlolesterol	6	MCL	HI = 1.05
Cadmium	kidneys	5	MCL	HI = 0.70
Chromium	no observed effect	100	MCL	HI = 2.34
1,1 Dichloroethane	no observed effect	81	AGQS	HI = 0.01
1,1 Dichloroethene	liver	7	MCL	HI = 0.002
Naphthalene	circulatory system	20	AGQS	HI = 0.015
cis 1,2 Dichloroethene	increased serum	70	MCL	HI = 0.49
Ethylbenzene	liver, kidneys	700	MCL	HI = 0.49
Tetrachlorethene	liver	5	MCL	HI = 0.04
1,1,1 Trichloroethane	CNS	200	MCL	HI = 0.70

All Interim Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination, must be met at the completion of the remedial action at the points of compliance. At this Site, interim cleanup levels must be attained throughout the entire Site-related plume that extends from Parcel 1 to Parcel 2 and off-Site to eastern abutting properties and is currently bracketed by Kelley Brook to the north. Compliance will be demonstrated by attainment of interim cleanup levels, or alternative protective levels as determined above, in all monitoring wells and area supply wells currently associated with the Site plume. EPA has estimated that the Interim Groundwater Cleanup levels will be obtained within 15 years after completion of the source control component.

After the Final Groundwater Cleanup Levels have been met and the remedy is determined to be protective, the groundwater treatment system will be shut down and dismantled. The groundwater monitoring program will be utilized to collect data for three years after shutdown but before dismantling to ensure that the cleanup levels have been met and the remedy is protective.

Soil Cleanup Levels

The Site has a long history of commercial use primarily as a waste oil storage and handling facility. In 1997, the Town of Plaistow changed the property zoning for both parcels at the Site to medium density residential (MDR 20) which is consistent with the residential character of the surrounding area. Earlier this year, the Town completed a reuse assessment for the property from which two similar reuse plans were adopted. Both plans conceptualize about 25 units of senior housing and a community center building on Parcel 1 and several recreational fields of various uses on Parcels 1 and 2. For purposes of determining potential human health risks and establishing subsequent soil cleanup levels, and in consideration of the above, EPA has determined that unrestricted residential use is the reasonably anticipated future use of the Site.

The State of New Hampshire has developed a series of soil remediation standards for varying levels of exposure. However, these standards have not been promulgated and therefore have not been used to established soil cleanup levels.

Soil cleanup levels for compounds of concern in surface (0 to 2 feet bgs) and shallow (2 to 10 feet bgs) soil exhibiting an unacceptable cancer risk and/or hazard index have been established to be protective of human health. Soil cleanup levels for known and suspected carcinogenic chemicals of concern (Classes A, B, and C compounds) have been set at a 1E-06 excess cancer risk level considering exposures via dermal contact, incidental ingestion and vapor inhalation. Cleanup levels for chemicals of concern in soils having non-carcinogenic effects (Classes D and E compounds) were derived for the same exposure pathway(s) and correspond to an acceptable exposure level to which the human population (including sensitive subgroups) may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1). Exposure parameters for the above pathways have been described in Section 3.0 and Appendix A of the Human Health Baseline Risk Assessment.

Lead has been shown to affect every system in the body and is classified as a probable human carcinogen, however the most sensitive target organ is the nervous system in young children. EPA has not established a reference dose (RfD) for lead because it appears that some observed effects occur at such low doses as to be essentially without a threshold. The Integrated Exposure and Uptake Biokinetic (IEUBK) model was used to evaluate the hazard potential posed by exposure of children less than 6 months to 7 years of age as the most sensitive receptor group. The inputs for the model assumed that a future child resident could be exposed to surface soils (0 to 1 foot) and sub-surface soils (0 to 10 feet) and considered background exposure to indoor and outdoor lead dust.

The following Table summarizes the cleanup levels for carcinogenic and non-carcinogenic chemicals of concern in surface and shallow soils protective of direct contact with soil.

Soil Cleanup Levels for the Protection of Human Health (0 to 10 feet below ground surface)				
Carcinogenic Compounds of Concern	**Cancer Classification**	**Soil Cleanup Level (mg/kg)**	**Basis**	**RME Risk**
Lead	B2	400	IEUBK model	n/a
benzo(a)pyrene	B2	0.4	risk	3.0E-06

PCBs	B2	0.5	risk	1.0E-06
Non-Carcinogenic Compounds of Concern	**Target Endpoint**	**Soil Cleanup Level (mg/kg)**	**Basis**	**RME Hazard Quotient**
Lead	CNS	400	IEUBK model	n/a
PCBs	immune system	0.5	risk	HI = 0.21

Based upon data developed in the RI and the Baseline Risk Assessment, remedial measures to address health risks associated with possible exposure to all contaminants in subsurface source soils are necessary to a depth of 10 feet. The data also suggests that several VOCs in area soils release to groundwater thereby contaminating groundwater. This phenomenon may result in an unacceptable risk to those who ingest, contact or inhale vapors associated with contaminated groundwater. Therefore, cleanup levels for VOCs in deep soils were established to protect the aquifer from potential soil leachate. Because unacceptable levels of contaminants other than VOCs will remain in soils below 10 feet after treatment, institutional controls will be required to prevent digging in these deeper soils.

Because of the presence of significant NAPL, standard leaching models were determined to be non-applicable to Site conditions. A Site-specific empirical leaching model was developed to estimate residual soil levels that are not expected to impair future ground water quality. The interim cleanup levels for groundwater were identified as described in Section L.12 (Interim Ground Water Cleanup Levels). The Site-specific leaching model was arranged such that the model output was consistent with the Interim Cleanup Levels for Ground Water. The empirical leaching model is described in Appendix H of the FS Report.

The table below summarizes the soil cleanup levels established to protect public health and the aquifer and were developed for soil contaminants that have the potential to leach.

Soil Cleanup Levels for the Aquifer Based on Leaching (Greater than 10 feet below ground surface)		
Compounds of Concern (COCs)	**Targeted Ground Water Level (ug/l) (Basis)**	**Soil Cleanup Level (mg/kg)**
alkylbenzenes	50 (AGQS)	20
benzene	5 (MCL)	0.1
cis-1,2 dichloroethene	70 (MCL)	2
ethylbenzene	700 (MCL)	20
naphthalene	20 (AGQS)	4
tetrachloroethene	5 (MCL)	0.5

1,1,1 trichloroethane	200 (MCL)	4
trichloroethene	5 (MCL)	0.2

These cleanup levels in soil were developed so that concentrations of contaminants leaching through the soil do not exceed groundwater cleanup standards, attain EPA's risk management goal for remedial actions, and have been determined by EPA to be protective. The soil cleanup levels must be met at the completion of the remedial action at the points of compliance generally described as shallow and surficial soils, and soil piles, located throughout the former operations area on Parcel 1 and extending onto the southern portion of Parcel 2, and deep soils (greater than 10 feet bgs) generally associated with the LNAPL zone beneath Parcel 1. For all soil, compliance will be determined through post-excavation and post-treatment confirmatory sampling.

Sediment Cleanup Levels

Numerical PRGs for sediment were not developed during the FS since this portion of the remedial action entails removal of visibly contaminated sediments from the oil breakout area. Sediments in this limited area (i.e., approximately 50 feet x 150 feet x 4 feet) were saturated by uncontrolled discharge from the LNAPL plume for several years prior to the installation of an effective interceptor trench in 1999. It was subsequently determined that numeric PRGs were necessary to adequately demonstrate that this portion of the remedy is protective. Sediment PRGs based on RME human health risks and ecological risks were then established. See Appendix H. Risk estimates were calculated based on existing data and exposure parameters contained in the RI, FS and risk assessment reports. EPA has established the following cleanup levels for sediment based on potential human health risks to a child wader and/or adult fisherperson.

Sediment Cleanup Levels				
Carcinogenic Compounds of Concern	Cancer Classifica-tion	Sediment Cleanup Level (mg/kg)	Basis	RME Risk
Arsenic	A	16.6	risk	1E-05
PCBs	B2	0.68	risk	1E-06
Non-Carcinogenic Compounds of Concern	**Target Endpoint**	**Sediment Cleanup Level (mg/kg)**	**Basis**	**RME Hazard Quotient**
PCBs	immune system	0.68	risk	HI = 0.17

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Beede Waste Oil Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

1. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls and institutional controls. More specifically, the remedy will involve excavation and off-Site disposal of contaminated soil at the Site to a depth of ten feet below ground surface.[14] This will allow for unrestricted residential use of the property. Further, soil deeper than ten feet will be treated in-situ via soil vapor extraction, possibly thermally-enhanced, to remove VOCs which are an ongoing source of groundwater contamination. Additionally, groundwater will be extracted and treated on-Site continuously until drinking water standards are achieved throughout the aquifer. Finally, a limited area of sediment will be excavated from Kelley Brook and fishing restrictions will remain in effect.

The selected remedy will reduce potential human health risk levels such that they do not exceed EPA's acceptable risk range of 10^{-4} to 10^{-6}, or New Hampshire's target risk goal of 10^{-5}, for incremental carcinogenic risk and such that the non-carcinogenic hazard is below a level of concern and will not exceed a hazard index of 1.0 It will reduce potential human health risk levels to protective ARARs levels (i.e., the remedy will comply with ARARs and To Be Considered criteria.) The remedy will also result in the restoration of on-Site wetlands and is expected to result in improved surface water quality in Kelley Brook. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

At the time that the ARAR-based Interim Groundwater Cleanup Levels identified in the ROD, and newly promulgated ARARs and modified ARARs that call into question the

[14]Most of the soil contamination is located within surface soils (0 to 2 feet bgs) on Parcel 1. Discreet areas of soil contamination extend into sub-surface soils (2 to 10 feet bgs). Contamination in deep soils (> 10 feet bgs) are considered inaccessible to current and future human receptors and will be remediated in-situ to remove VOCs only. Because unacceptable levels of contaminants other than VOCs will remain after treatment, and because the State considers 0-15 feet accessible for unlimited use, institutional controls will restrict digging below 10 feet.

protectiveness of the remedy, have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual groundwater contamination to determine whether the remedy is protective. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion of and direct contact with groundwater and inhalation of VOCs from domestic water usage. If, after review of the risk assessment, the remedy is not determined to be protective by EPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the Final Groundwater Cleanup Levels for this Record of Decision and shall be considered performance standards for any remedial action.

2. The Selected Remedy Complies With ARARs

Overall, the selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site. This section briefly summarizes the most significant chemical, location and action specific ARARs for the remedy. Appendix B to this ROD summarizes the various environmental statutes and regulations discussed below, as well as their impact on remedial activities. A list of the Federal and State chemical, location and action specific ARARs associated with the preferred remedy follow at the end of this section.

Chemical-Specific ARARs

Chemical-specific ARARs govern the extent of site cleanup and provide either actual clean-up levels or a basis for calculating such levels. These requirements are usually health or risk based numerical values or methodologies which, when applied to site-specific conditions, result in numerical values which help define the degree of cleanup.

The source control component of the remedy, eliminates unacceptable risk to human receptors through the excavation and off-Site disposal of shallow and subsurface soil which contains excess levels of PCBs, lead and benzo(a)pyrene throughout Parcel 1, generally in the top two feet, but also in discreet areas to a depth of 10 feet below ground surface. Additionally sediments which contain excess levels of PCBs and arsenic will be excavated from the oil breakout area of Kelley Brook. Although there are no federal or state ARAR-derived soil or sediment cleanup standards, EPA assesses risk and derives target cleanup levels which are protective of human health and the environment by utilizing a site-specific risk assessment process that relies on reasonable assumptions about exposure and up to the date information about toxicity. Based on this risk assessment process, EPA developed target cleanup levels of 0.5 mg/kg for total PCBs, 400 mg/kg for lead and 0.4 mg/kg for benzo(a)pyrene in soil to a depth of 10 feet below ground surface and 0.68 mg/kg. For sediment, target cleanup levels for total PCBs is 0.68 mg./kg and for arsenic, 16.6 mg/kg . These target levels meet both EPA and

DES cancer and non-cancer risk levels developed under federal and state guidance used to evaluate risk which are cited as "to be considered" in Appendix B.

For soils below 10 feet, SVE treatment will reduce VOC concentrations in this soil to residual levels that, when leaching into the groundwater aquifer, do not exceed Safe Drinking Water Act Maximum Contaminant Levels (MCLs) or more stringent New Hampshire Ambient Groundwater Quality Standards (AGQSs). Because this aquifer is considered a high value aquifer for use as potential drinking water, MCLs, which measure drinking water at the tap, considered relevant and appropriate for measuring aquifer contaminant concentrations. State AGQSs are promulgated specifically for groundwater aquifers and are applicable to this Site. A Site-specific leaching model was developed to estimate acceptable residual soil levels. Based on this model, EPA developed target cleanup levels for eight VOCs present in soil deeper than 10 feet which are listed in the Deep Soil Cleanup Table in Section L.6.

The management of migration component of the remedy will actively restore the aquifer through extraction and on-Site treatment of contaminated groundwater. EPA has established interim target cleanup levels for the 13 VOCs, alkylbenzenes and four metals in groundwater that are set at Safe Drinking Water Maximum Contaminant Levels and, where more stringent, New Hampshire Ambient Groundwater Quality Standards. Similar to deep soil, MCLs are relevant and appropriate to groundwater cleanup; AGQSs are applicable. Once the interim target cleanup levels have been attained, and no other contaminants are present in groundwater that exceed MCLs and AGQSs for a period of three consecutive years, a Site-specific risk assessment will be performed on the aquifer to determine the cumulative risk from residual levels of groundwater contamination. Current federal and state guidance used to evaluate risk are cited as "to be considered" in Appendix B. If excess risk is determined to be present, then the residual levels will not be considered protective and the groundwater treatment system will continue to operate until the concentrations reach and remain at protective, risk-based levels for a period of three consecutive years. These risk-based levels shall constitute the final target cleanup levels for groundwater.

EPA's guidance entitled, "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, November 2002," will be considered to determine both when monitoring structures within the vicinity of the Site for vapors from contaminated groundwater is appropriate and to determine safe levels. It will also guide any necessary mitigative actions if such actions are needed.

Location-Specific ARARs

Location-specific ARARs are restrictions relating more directly to the geographical or physical setting or position of the site. They are generally restrictions on the conduct of activities solely because of a site's particular characteristics or location. This cleanup occurs along the southern bank of Kelley Brook, which includes a wetland and floodplain area.

Federal and state location-specific ARARs address floodplain and wetland management, as well as protection of fish and wildlife. The goal of these regulations is to protect resource areas. They set performance standards for the level of protection needed to ensure the resource areas are unharmed or that any harm is minimized during the design and implementation of projects built in these areas. A general description of the significant location-specific ARARs and how the remedy will meet the requirements is set out below.

Several regulations (Wetlands and Floodplain Protection Acts, Section 404 of the Clean Water Act) require a determination that no practical alternative exists to the proposed action. Significant soil, sediment and groundwater contamination are present in wetland and floodplain areas at the Site. EPA, after soliciting and receiving public comment, hereby makes the determination that the selected remedy is the best practical solution for remediating the Beede Waste Oil Site. Source control requires excavation of soil and sediment, as well as the installation of vacuum extraction and possibly steam injection wells, in the wetland and floodplain areas. Groundwater extraction and treatment requires the installation of extraction wells, and infiltration galleys or effluent discharge pipes, some of which may be placed in the wetland and floodplain areas. Since the landfill sits directly within a wetland, the entire area surface and subsurface soil will be excavated. Wells and treatment facilities may also be installed completely or partially in wetlands. Best available measures will be used throughout the Site to minimize adverse effects on the wetlands, wildlife and its habitat and to control flooding. Damage to these wetlands will be mitigated through erosion control measures and proper regrading and re-vegetation of impacted areas with indigenous species. Following excavation activities, wetlands will be restored consistent with the requirements of the federal and State wetlands protection laws and regulations and with the federal requirements set forth in Executive Order 11988 (Protection of Floodplains).

Many regulations also require the EPA to coordinate with appropriate agencies when activities may affect jurisdictional domains. EPA has provided formal notice to the US Fish and Wildlife Service, the National Oceanic and Aquatic Administration and the New Hampshire DES and will continue to coordinate with these agencies during design and remediation activities.

Action-Specific ARARs

Action-specific ARARs are usually technology- or activity-based limitation or requirements that control actions at CERCLA sites. These requirements generally define acceptable treatment, storage and disposal procedures for hazardous substances, solid waste and PCB contaminated media during the response action and establish air emissions standards for discharge from treatment systems, as well as specify standards for discharge of treated water to groundwater or surface water bodies.

Wastes that contain greater than 50 ppm total PCBs or, for releases which occurred after July 2, 1979, contain any concentration of PCBs if the original source contained greater than 50 ppm total PCBs, are managed under the Toxic Substance Control Act (TSCA). Areas of soil and sediment on-Site are contaminated with PCBs at concentrations greater than 50 ppm total PCBs. Also, although the releases at the Site occurred from multiple sources over an extended time period, historical information suggests that releases did occur after July 2, 1979, from source units (i.e., storage tanks) which likely contained greater than 50 ppm total PCBs.

TSCA regulates disposal of PCB contaminated soil and sediment (i.e., PCB-remediation waste). TSCA allows for risk-based disposal of PCB-remediation waste if the Regional Administrator finds, after a review of information concerning the Site contamination and cleanup plan, that the disposal will not pose an unreasonable risk to health and the environment. Based on the Administrative Record for this Site, which contains the information required under TSCA, the Regional Administrator finds that the transport of excavated PCB contaminated soil and sediment for off-Site disposal does not pose an unreasonable risks to human health or the environment as long as the following conditions are met:

1. All excavated soil and sediment is disposed of in accordance with TSCA and based on in-place PCB levels, not subject to dilution.

2. Protocols, developed in accordance with TSCA, will be developed and maintained for the following activities:
   A. Sampling of all excavated material prior to offsite transportation; and
   B. Best efforts are used to decontaminate all equipment used when handling TSCA contaminated material to avoid mixing with non-TSCA material.

3. Stockpiled material shall be bermed while awaiting transport to capture runoff. Runoff shall be collected and either treated at the site groundwater treatment plant or disposed offsite, as appropriate.

4. Air monitoring, and dust suppression measures for PCBs, as described in the Proposed Plan, shall be maintained until excavation and transport of PCB contaminated soil and sediment is complete. Groundwater monitoring for PCBs will be maintained until it is shown that PCBs are not present in groundwater at a level to pose a risk to human health and the environment.

Issuance of this Record of Decision indicates approval.

Remedial action includes construction of a vacuum extraction system to reduce VOC concentrations in soil and construction of a separate treatment system to remove VOC and metals from groundwater. These treatment systems will be constructed, operated, maintained and eventually closed consistent with various subsections of Part 264 of the Resource Conservation and Recovery Act (RCRA). For instance, all tanks, containers, and process vents will be constructed to handle hazardous waste, as appropriate. Frac tanks holding process water and rolloff containers holding filtered sludge cakes will be covered and maintained in sound condition to prevent leaks. All hazardous material will be either characterized and live loaded for immediate offsite disposal, or, in the case of the sludge cakes, stored in rolloffs briefly for offsite disposal. No material will be stockpiled long enough to trigger RCRA stockpiling or TSCA storage requirements. Air emissions from processing equipment will meet RCRA and Clean Air Act emission requirements and will comply with the EPA air stripper guidance through the use of carbon filters and other engineering controls. Oil recovered during the SVE phase of the remedy will be collected in storage tanks and sent offsite for disposal or recycling in accordance with TSCA or oil recycling regulations as appropriate.

In addition, site excavation activities will be conducted so as to minimize fugitive dust emissions. During shallow soil, waste pile and landfill material removal, dust suppression methods will be used as necessary. Well installation for treatment and monitoring components of the remedy will be installed so as to minimize disruption to wetlands when located in or near wetlands. Once the remedy is completed, the well will be decommissioned and abandoned in place by an appropriate method as mandated by RCRA and state well abandonment regulations. All equipment, including trucks carrying hazardous waste offsite will be decontaminated at the onsite decontamination area. Resulting water will be collected and treated onsite or sent offsite for disposal.

The water collected during water table depression for the SVE System and that resulting from the treatment system constructed to address groundwater contamination requires the on-Site discharge of a significant volume (est. 80 gpm) of treated groundwater. As explained under the pre-design discussion for the selected remedy, discharge options include construction of on-Site infiltration galleys or discharge directly to Kelley Brook. If groundwater is discharged through infiltration galleys to the on-Site aquifer, treated effluent will need to attain federal, and more stringent state drinking water standards, consistent with Safe Drinking Water Act Maximum Contaminant Levels and State of New Hampshire Ambient Groundwater Quality Standards. If groundwater is discharged directly to Kelley Brook, the treated effluent will need to meet the substantive requirements of federal discharge standards (NPDES) and more stringent state surface water quality regulations. These regulations establish surface water quality criteria which will dictate Site-specific discharge standards for toxic substances and other water quality parameters. Generally, surface water quality criteria are more stringent than drinking water standards, particularly for a low-flow stream like Kelley Brook. Water from landfill excavation activities, which will occur before the groundwater treatment facility is constructed, will be sent to either a local POTW or a hazardous waste facility depending on characterization results.

While the remedy is ongoing, state law mandates that a groundwater management zone (GMZ) be designated whenever drinking water standards are exceeded in groundwater. Until contaminant concentrations in groundwater reach AGQSs, the GMZ acts as an institutional control in that it prohibits the use of groundwater. The delineation of the GMZ will be determined during predesign. The GMZ will remain in place until the remedy is complete and levels reach cleanup standards. Both RCRA landfill regulations and state groundwater regulations require long-term monitoring programs and a long-term monitoring program is included in the remedy. Both federal and more stringent state drinking water standards and state surface water standards will be used in the monitoring program to determine whether removing the source of contamination through soil and sediment excavation and through treatment of deeper soil and extracted groundwater results in reaching these water quality levels.

Although not identified as ARARs, all remedial action will comply with OSHA regulations for worker safety and with RCRA and DOT regulations for offsite transportation of hazardous waste.

Source Control (SC-5) and Management of Migration (MOM-3) ARARs

- CAA - National Ambient Air Quality Standards (40 CFR 52.21)
- CWA - Ambient Water Quality Criteria (40 CFR 122.44)
- CWA - Dredge and Fill (40 CFR 230)
- Fish and Wildlife Coordination Act (16 USC 661)
- Protection of Wetlands (Executive Order 11990)
- Protection of Floodplains (Executive Order 11988)
- RCRA Air Emissions Standards (40 CFR 264)
- RCRA - Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))
- RCRA - Hazardous Waste Facility Requirements (40 CFR Part 264)
- RCRA - Used Oil Management Standards (40 CFR Part 279)
- SDWA - Maximum Contaminant Levels (40 CFR 141.11 - 141.16)
- TSCA - PCB Remediation (40 CFR 761.61(c))
- Underground Injection Control Regulations (40 CFR Parts 144, 145, 146, and 147)

- New Hampshire Abandonment of Well Rules - (We 604)
- New Hampshire Criteria and Conditions for Dredge and Fill in Wetlands (Env-Wt 300)
- New Hampshire Ambient Groundwater Quality Standards (Env-Ws 316, 317, 319)
- New Hampshire Fugitive Dust (Env-A 1002)
- New Hampshire Groundwater Discharge Permit Rules (Env-Ws 1501.01-1503.03)
- New Hampshire Groundwater Management and Groundwater Release Detection Permit Rules (Env-Wm 1403.03 - 1403.050
- New Hampshire Permits for RSA 485-A:17 Activities (Env-Ws 415.11)
- New Hampshire Protection of State Surface Water Regulations (Env-Ws 401 - 405)
- New Hampshire Requirements for Management of Used Oil (Env-Wm 807)
- New Hampshire Solid Waste Rules (Env-Wm 101.04)
- New Hampshire Surface Water Quality Regulations (Env-Ws 1700)
- New Hampshire Toxic Air Pollutants (Env-A 1300)

Policies and Guidance

The following policies, advisories, criteria, and guidance will also be considered during the implementation of the remedial action. For a complete list description of the Source Control and Management of Migration policies and guidance, see Appendix B of this ROD.

- EPA Region 1 - Final Groundwater Use and Value Determination Guidance
- EPA Health Advisories, Human Health Risk Assessment Guidance and Ecological Risk Assessment Guidance
- EPA Health Assessment Cancer Slope Factors (CSFs)
- EPA Memorandum "Policy on Floodplains and Wetland Assessments for CERCLA"
- EPA Risk Reference Doses (RfDs)
- EPA Draft Guidance for Assessment of Vapor Intrusion, November 2002
- New Hampshire DES Contaminated Risk Characterization and Management Policy (RCMP)
- Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-28, Control of Air Emissions for Air Strippers at Superfund Sites

3. The Selected Remedy is Cost-Effective

In EPA's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The net present worth of the selected remedy is **$48 million** (SC-5 = $33 million and MOM-3 = $15 million).

Specifically with regard to the selected source control alternatives, SC-1 (no action) and SC-2 (limited action) did not meet the threshold criteria and were dismissed from further consideration. Although alternative SC-3 is $14 million less than the selected alternative SC-5, contamination would remain at a depth less than 10 feet below the ground surface and thus would not be protective for the desired future residential use of the property. Also, alternative SC-3 may not be protective for ecological receptors such as burrowing mammals. The remaining source control alternatives, SC-4 and SC-6 offer similar levels of protectiveness as SC-5 yet are considerably more expensive than SC-5 .

With regard to the selected management of migration alternative, MOM-1 (no action) also failed to meet the threshold criteria and was not carried forward in the analysis. MOM-2 (limited action) fails to protect of ecological receptors since the groundwater plume would continue to discharge, uncontrolled, to Kelley Brook. Additionally, MOM-2 would require an estimated 40 years or more to achieve drinking water standards which is inconsistent with the “high value” determination for the aquifer and would not satisfy the statutory preference to treatment. Both of the active treatment alternatives differ only in the estimated pumping rate for groundwater extraction (MOM-3 at 200 gallons per minute verses MOM-4 at 85 gallons per minute), however MOM-3 and MOM-4 are each estimated to cost $15 million. MOM-3 is more cost effective since it is estimated to achieve drinking water standards in less than half the time of MOM-4 (MOM-3 at 15 years verses MOM-4 at 35 years).

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once EPA identified those alternatives that attain or, as appropriate, waive ARARs and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-Site land disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

① *Long Term Effectiveness and Permanence*

For source control, the selected remedy and SC-4 and SC-6 provide reliable, permanent protection to human and ecological receptors through a combination of treatment and removal or complete removal of contaminated soil/sediment. The selected remedy was chosen because it offers the best balance of removing contaminated soils most available to receptors and applying treatment to deeper soils to protect groundwater. SC-4 involves removal of significant amounts of soil that must be characterized and disposed of offsite. This results in tremendous handling, storage and transportation of contaminated media posing significant short-term risk to workers and the community and incurs at least $10 million in costs above the selected remedy. SC-6 relies most heavily on treatment which poses similar risks to the community and workers in that equipment most operate for significantly longer than the selected alternative for almost equal levels of reduction in long-term risk. The price differential moves higher with SC-6A being about $20 million higher than the selected remedy without much added level of protectiveness.

SC-2 and SC-3 fall short of the selected remedy in terms of permanence in that SC-3 only removes a small amount of contaminated material and instead caps in place the surface soil that is most accessible to current and future site users. In SC-3, the cap must be inspected and maintained regularly to provide an effective, long-term remedy. SC-2 is not a permanent solution and does nothing to protect against direct contact with contaminated soils except to fence the site and put deed restrictions in place. All alternatives require institutional controls to prevent the use of groundwater until cleanup levels are achieved and to prevent disturbing soil below 10 feet (which will remain indefinitely unless further cleanup actions are taken beyond those described in this document). However, SC-2 and SC-3 rely more heavily on controls (prevent site access at all, prevent disturbing the soil cap) for even a minimal degree of protectiveness.

With regard to the management of migration, the selected alternative MOM-3 will provide long term effectiveness and elimination of unacceptable levels of human health risk by active groundwater extraction and treatment, and natural attenuation for more marginal areas of groundwater contamination. The groundwater extraction/treatment system will consist of conventional and well proven technologies, and is expected to be highly reliable, with proper operation and maintenance. Prior to groundwater attaining MCLs/AGQSs, MOM-3 will rely on institutional restrictions (GMZ) and engineering controls (POEs) to protect human health. The effectiveness of institutional controls and POEs requires ongoing enforcement and maintenance. The selected alternative MOM-3 will provide the highest degree of effectiveness and permanence since MOM-3 is estimated to achieve drinking water standards in less than half the time of MOM-2 or MOM-4.

② *Reduction of Toxicity, Mobility or Volume Through Treatment*

SC-5 strikes the best balance of all the alternatives in reducing toxicity, mobility and volume of contamination through treatment. SC-4 does not include any onsite treatment and instead sends both shallow and deep soil offsite for disposal. Conversely, SC-6 treats all soil and sediment onsite; however, it produces significantly more treatment residual byproduct contamination than SC-5 that must be disposed offsite. SC-1, SC-2 and SC-3 range from absolutely no treatment (SC-1) to hot spot treatment only with capping in place of a substantial amount of contaminated soil (SC-3). SC-5 takes slightly longer to reduce toxicity, mobility and volume of contamination (4-5 years) than SC-4 (3-4 years); however, at the completion of the remedy, 70,000 cubic yards more material has been actively treated than would be in SC-4. Moreover, SC-5 achieves its results one year sooner than either SC-6 option and for $24 million less than SC-6A and $10 million less than SC-6B.

With regard to management of migration, the selected alternative MOM-3, will remove organic contaminants, consisting largely of VOCs, by air stripping and liquid phase activated carbon. MOM-3 also includes metals removal by chemical precipitation. The removal of organics and metals from Site groundwater will be permanent. The selected alternative MOM-3 will achieve the greatest reductions since the higher pump rate (MOM-3 at 200 gpm verses MOM-4 at 85 gpm) will achieve drinking water standards in about half the time (MOM-3 at 15 years verses MOM-4 at 35 years). MOM-1 and MOM-2 do not reach groundwater cleanup levels for 40 years and rely completely on natural attenuation rather than treatment. Residuals anticipated to be generated from treatment of groundwater include dewatered metal sludge, organic-phase liquid, spent liquid-phase activated carbon, and potentially spent gas-phase activated carbon. Recovered organics (e.g., as organic-phase liquid and spent liquid-phase activated carbon) will be sent off-Site for treatment/disposal (e.g., thermal destruction). The dewatered metal sludge, which is anticipated to be classified as non-hazardous, will be treated/disposed off-Site. Both alternatives MOM-3 and MOM-4 would be expected to generate similar treatment residuals.

③ *Short Term Effectiveness*

Again, the selected remedy offers the best balance of all the alternatives in terms of short-term risks generated while achieving a high level of protectiveness. Soil and sediment excavation and material handling for all alternatives will generate risk to workers (exposure to contaminated media, dust and treatment process residuals) and the surrounding community (truck traffic, noise, dust, and potential spills) during operations. However, SC-5 treats deeper soil insitu which minimizes these risks down from those produced during SC-4 excavation of shallow and deep soils. SC-6 involves both insitu and exsitu treatment which produces similar risks as the SC-5 insitu treatment component (as well as additional risks associated with exsitu treatment); however, SC-6 must operate for at least one year longer than SC-5 thus prolonging the exposure to these risks. The remaining alternatives, SC-1, SC-2 and SC-3, while producing little short-term risk to workers or the surrounding community during operations, likewise have little or minimal long-term protectiveness.

The time frame to achieve RAOs is approximately 4-5 years for the selected alternative SC-5. This is slightly longer than the time frame required for alternatives SC-3 and SC-4, but slightly shorter than the time frame for SC-6.

Short-term risks for the selected remedy and MOM-4 are essentially the same since the only difference between the two is the duration of pumping activities. The advantage for the selected remedy is that these risks end sooner in that groundwater will reach cleanup levels in 15 years whereas MOM-4 will not reach cleanup levels for 35 years. Additionally, existing water supply wells will be usable without POC systems in five years for MOM-3 but not for 12 years in MOM-4. Because MOM-1 and MOM-2 do not involve treatment, no short-term risks exist, but RAOs are not achieved for a much longer period of time than for MOM-3.

④ *Implementability*

The selected remedy does not involve any extraordinary measures to implement. For source control, excavation and backfilling activities will be carried out with typical earthmoving equipment. Disposal sites for hazardous and non-hazardous material are available to accept the quantities generated from excavation, and wetland restoration stock is similarly available. SVE is a proven technology and equipment, personnel and materials are readily available. Thermal enhancement of the system, if necessary, is still considered an innovative technology; however, several full-scale projects have demonstrated its constructability and effectiveness. Like SVE, equipment, personnel and material for thermal enhancement is available as well. Because SC-3, SC-4 and SC-6 involve a combination of the above activities, the selected remedy is not particularly superior or inferior to the others in terms of implementability. The balance falls more than anything else on the length of time these items are needed. SC-3 and SC-4 require more extensive use of earthmoving equipment and personnel than SC-5 and SC-6 more equipment and personnel associated with treatment components than SC-5. SC-1 and SC-2 are especially easy to implement in that there is little or no site activities.

Both MOM-3 and MOM-4 are similarly easy to implement in terms of proven, reliable technology and availability of personnel, equipment and material. The difference is the length of time needed to run the groundwater extraction and treatment systems; MOM-3 requires only 15 estimated years of operation; MOM-4 requires 35 years.

Administratively, SC-3 is slightly more challenging in that deed restrictions from site owners are necessary to protect the cap; all other alternatives, except SC-4, require restrictions against digging in deep soil.

⑤ *Cost*

Costs are summarized in the tables below as estimated capital and net present-worth costs. Operation and Maintenance (O&M) costs are incorporated under the net present-worth costs. Costs for the selected remedy are highlighted in **bold** text.

	SC-1	SC-2	SC-3	SC-4	**SC-5**	SC-6A	SC-6B
Capital Cost	$0	$99,306	$9.25 million	$41.23 million	**$24.42 million**	$57.27 million	$36.21 million
Net Present Worth Cost	$156,912	$1.47 million	$17.98 million	$41.53 million	**$31.81 million**	$57.58 million	$43.55 million

With regard to source control, the selected remedy offers the best balance of achieving a high level of protectiveness in the most cost effective manner.

	MOM-1	MOM-2	**MOM-3**	MOM-4
Capital Cost	$16,192	$102,579	**$5.94 million**	$4.45 million

NPW Cost	$1.93 million	$5.69 million	**$15.58 million**	$15.53 million

With regard to the management of migration, of the active remedial alternatives, MOM-4 has slightly lower capital costs than MOM-3. However, since MOM-4 requires a longer estimated period of operation, both MOM-3 and MOM-4 have similar net present-worth costs.

5. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The principal elements of the selected remedy are source control (SC-5) and management of migration (MOM-3). These elements address the primary threats at the Site which include contamination of soil, sediment and groundwater. The selected remedy partially satisfies the statutory preference for treatment as a principal element by actively reducing the toxicity, mobility or volume of groundwater and deep soil through active treatment. A groundwater extraction and treatment system will be constructed on-Site to remove VOCs, metals and other contaminants. Treated groundwater, which achieves drinking water standards, will be returned to the aquifer or, if more stringent surface water discharge standards can be met, discharged on-Site to Kelley Brook. Soil deeper than 10 feet below ground surface will be treated in-situ through construction of a soil vapor extraction (SVE) system.

To remain cost effective, shallow soil, soil piles and sediment will be excavated and removed from the Site, rather than treated on-Site. The final disposition of this soil will involve treatment and/or disposal, as deemed appropriate by the recipient facility. It is anticipated that soils which require disposal at a RCRA or TSCA hazardous waste facility will be treated, whereas soils which do not, will likely be disposed in a solid waste landfill. Overall, a majority of the principal threat materials, that is the materials which contain the highest levels of contaminants and therefore constitute the greatest risks to human and ecological receptors, are expected to be treated on or off-Site.

State Acceptance

The State supports the selected remedy as described in this Record of Decision since it involves active and permanent treatment, will allow for residential reuse of the Site property and will restore groundwater in this State-designated High-Value aquifer to drinking water quality standards in the shortest possible time frame.

A concurrence letter from the State of New Hampshire's Department of Environmental Services is attached in Appendix **A.**

Community Acceptance

The public generally supports the selected remedy as described in the Record of Decision since it involves removal of the sources of contamination, will restore groundwater in currently impacted supply wells and throughout the aquifer to drinking water standards in the shortest possible time frame, and will allow for restoration of the Site property to be used for residential and recreational purposes. The Town of Plaistow recently approved reuse plans which include mixed residential/recreational use of the property.

6. Five-Year Reviews of the Selected Remedy are Required

Because the selected remedy will result in hazardous substances remaining on-Site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a proposed plan for source control and management of migration remediation of the Site on June 19, 2002. The source control portion of the preferred remedy included excavation and off-Site disposal/treatment of surficial and shallow soil, soil piles and sediment and soil vapor extraction, possibly thermally-enhanced, for soil deeper than ten feet below ground surface (SC-5). The management of migration portion of the preferred remedy included extraction and treatment of contaminated groundwater, with limited natural attenuation of portions of the plumes. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary. However, the following minor modifications to the preferred alternative have been incorporated.

1. Treatment Building - The Proposed Plan included the construction of a building to house the groundwater treatment system. The potential use of the existing 10,000 square foot on-Site commercial building for remedial activities was raised during the proposed plan comment period and during the Town's reuse process. The existing building appears to be in sound condition and is of adequate size to house the treatment equipment. The ROD includes an assessment of the building and evaluation of its potential use to support remedial activities. If deemed appropriate, the building may be used for housing the treatment equipment, office space, storage and possibly on-Site lab equipment. Such use would require that access to the building be obtained from the property owner.

2. Current NTCRA System - The current non-time critical removal action (NTCRA) must be completed prior to the initiation of the soil excavation activities associated with the selected source control remedy. The NTCRA system is co-located within the areas of soil contamination which prevents excavation of soil or installation of the SVE system. The

proposed plan and FS Report include the decommissioning of the 143 vacuum extraction wells and associated piping, treatment buildings and oil interceptor trench. As explained in the above description for source control, the existing wells, associated piping and treatment buildings will be assessed and utilized to the extent possible for the planned SVE system. The extent to which the NTCRA system can be re-used will be dependent upon the results of the pre-design studies. If the studies conclude that thermal-enhancement of the SVE system via steam injection *is* required, it is expected that much of the existing NTCRA system will *not* be re-used since well and piping materials are not suitable for the temperatures which thermal-enhancement would require.

3. MOM-3 Extraction System - The Proposed Plan specifies the installation of 7 extraction wells, 40 infiltration wells, and a treatment system with a conceptual design capacity of 200 gpm. As explained in the above description for groundwater treatment, the system parameters, including the exact number of extraction and infiltration wells, their placement and the design capacity of the system, will be determined through on-Site pre-design studies. The purpose of the studies are to determine the most effective extraction rate and well locations possible, based on updated information, to obtain the goal of complete aquifer restoration in no more than 15 years, and restoration of drinking water quality in currently impacted supply wells in no more than 5 years from system start-up. This study will also determine the need for additional de-watering wells to achieve a lowering of the water table necessary to implement SVE.

4. Additional Guidance To Be Considered - Subsequent to issuing the Proposed Plan, EPA issued a guidance entitled, "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils" in November 2002. This guidance requires an evaluation of indoor vapor intrusion of any structure within 200 feet of a groundwater plume. Because current structures exist within this zone and because the anticipated future use of the Site is residential, this guidance has been included in the ARARs section as a TBC and will be used to guide monitoring plans to determine safe levels of indoor vapors, as well as provide direction on when mitigative actions are necessary.

O. STATE ROLE

The New Hampshire Department of Environmental Services has reviewed the various alternatives and has indicated its support for the selected remedy. The State was the lead agency performing the remedial investigation, risk assessment and feasibility study and has determined that the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The State of New Hampshire concurs with the selected remedy for the Beede Waste Oil Site. A copy of the declaration of concurrence is attached as Appendix A.

RESPONSIVENESS SUMMARY

Part 3

UNITED STATES OF AMERICA

ENVIRONMENTAL PROTECTION AGENCY

BOSTON REGION

In the Matter of:

PUBLIC HEARING:

RE: BEEDE WASTE OIL SUPERFUND SITE

LOCATED IN PLAISTOW, NEW HAMPSHIRE

Vic Geary Center
Greenough Road
Plaistow, New Hampshire

Wednesday
July 17, 2002

The above entitled matter came on for hearing, pursuant to Notice at 7:00 o'clock p.m.

BEFORE:

MICHAEL JASINSKI, Hearing Officer
N.H./R.I. Section Chief
JIM DILORENZO, Remedial Project Manager
Beede Waste Oil Superfund Site
EPA
Regional Office, Suite 1100
One Congress Street
Boston, MA 02114

RICHARD H. PEASE, Supervisor
Remedial Emergency Section
ROBERT MINICUCCI, Community Relations Coordinator
N.H. Department of Environmental Services
Waste Management Division
6 Hazen Drive
Concord, NH 03301-6509

ORIGINAL

P R O C E E D I N G S

(7:00 p.m.)

THE HEARING OFFICER: Good evening. I'd like to welcome you to a public hearing for the Beede Waste Oil Superfund Site located in Plaistow, New Hampshire.

My name is Michael Jasinski. I am the Section Chief for the New Hampshire and Rhode Island Superfund Section at EPA's Regional Office in Boston. I'll be the Hearing Officer and Moderator for tonight's proceedings.

The purpose of tonight's meeting is to present to you the proposed plan for the Beede Waste Oil Superfund Site and accept your oral comments on that proposed plan. We will not be responding to your formal comments tonight. However, we will be preparing a response in this summary that will address each and every one of your oral comments we receive, and that document will be available in the local repository in Plaistow and at EPA's Boston Office. We will also have that document available as part of the record of decision, and that will be made available, once we select the remedy for the Beede Waste Oil Superfund Site.

We have a few individuals with us tonight from EPA and New Hampshire DES. I'd like to have them introduce themselves right now.

MR. PEASE: My name is Richard Pease. I'm the Remedial Project Manager -- State Remedial Project Manager for the Beede Waste Oil Site.

MR. DiLORENZO: Jim DiLorenzo, I'm the EPA Remedial Project Manager for the Beede Waste Oil Site.

MR. MINICUCCI: Robert Minicucci, New Hampshire DES, Energy Relations for this site.

THE HEARING OFFICER: I'd like to go over the format for tonight's meeting. It's going to be in three parts.

Jim will give you a brief presentation, first, an overview of the site background and the investigations undertaken to date.

He will then give you a brief review of the proposed plan for the Beede Waste Oil Superfund Site. At that point in time, we will open it up for clarifying questions on what Jim has presented to you tonight. Okay?

Then we will begin the formal public hearing to accept your oral comments. Again, we will not be able to respond to your oral comments during that formal period.

I want to try and limit your comments to ten minutes, if I can. If you have a longer statement than that, please try to summarize your statement and provide us in writing your statement for the record. Your comments in their writing in full will be provided to our stenographer, who is taking the meeting minutes for that formal section verbatim and will provide that verbatim record in the response and the summary with your responses.

After all the oral comments have been recorded tonight, I will close the formal hearing. If you wish to submit a written comment tonight, Jim or myself will be available to accept those comments for the record.

And just to remind you, tonight's purpose is to discuss Beede Waste Oil Superfund Site Proposed Cleanup Plan, and we will, again, I repeat, not be able to respond to your oral formal comments tonight.

We will remain after this meeting to answer any clarifying questions or informally discuss any questions you have, and even before I saw a lot of people were talking to Jim or Dick and Bob about some questions. We'll be here to answer any of those issues informally on the Beede site after that.

With that, are there any questions on the format for tonight's hearing? Any questions at all?

Okay. I will turn over the proceedings tonight to Jim to give you a short brief overview of the site investigations to date and the proposed plan.

Jim.

(Whereupon, Mr. DiLorenzo gave a slide presentation of the proposed cleanup plan.)

THE HEARING OFFICER: Formal process of accepting oral comments on the Beede Waste Oil Superfund Site Proposed

Cleanup Plan that EPA has presented to you this evening, that is undergoing a 60-day public comment period.

I would call on you to make your statement. As I do, I would ask you to come up to the podium, front of the room. We have a court stenographer who is taking minutes verbatim, and please speak loudly. Please loud enough so everybody can hear you, including yourself. State your name, your affiliation with the Beede Waste Oil Superfund Site and make your statement.

As I said, I'll give you about ten minutes to do that, and if you have a lengthy statement to make, you may want to summarize and give us the text of your statement.

I have two requests here for statements right now. The first one would be from Jeff Rose.

MR. ROSE: My name is Jeff Rose and I work for Senator Bob Smith. I don't have any specific comments with regards to the proposed remediation plan or the RIFS, other than to state that Senator Smith is ranking member of the Environment Public Works Committee, recognizes this as a top priority and will continue his work in Washington to make sure that this site receives its fair and timely cleanup, and he's committed to continuing to work with the EPA, the DES and the Town of Plaistow to ensure that.

Thank you.

THE HEARING OFFICER: Thank you.

I have a second request from a John Scruton, Plaistow Town Manager, and then I will open it up to anybody who raises their hand.

MR. SCRUTON: The Board of Selectmen at the July 1st meeting reviewed the proposed cleanup and the matter has been discussed with department heads and we offer the following observations:

The Town thanks the EPA and the New Hampshire Department of Environmental Services for its work by examining the site, developing a plan to restore the site to residential housing standards as soon as practical.

As you know, the town is requesting planning money to help plan for the future use of the site. We believe that it does have potential for future use and we would like to see that restored to those kinds of uses, all of them conditioned upon a thorough cleanup of the site.

We fully support the cleanup options selected by the EPA and presented at the informational hearing -- meeting, June 26th, at the MOM-3 and SC-5; strongly oppose any less active form of cleanup. We would strongly oppose all plans that would take longer to clean up the site.

The supported plans include the excavation and removal of contaminated soil, steam, enhanced soil vacuum extraction for deeper soil, wetlands restoration, and a high rate pump rate for treating of groundwater.

Now, while we support the soil and groundwater cleanup targets, we would also support any stricter standards that the EPA and NH DES might select; and we would strongly oppose any standards for cleanup that were less stringent than the current proposed standards.

There are a number of practical concerns I'd like to bring up. I've listed six in the handout and Merilyn Senter just mentioned a seventh.

The first one is the roads are not designed to handle truck traffic. I brought this up June 26th, but I did want to make it part of the formal hearing. We have a major concern with deterioration of the road from extensive heavy truck traffic that is planned. And what we would like is part of the cleanup money to be used to reconstruct the road routes that will be used, and that reconstruction to take place before the work is done and before it begins. And then at the conclusion, any repairs that needed to be made, and then a final wearing coat be put on again at that time to leave the roads in excellent condition.

The length of road to be constructed would depend upon the proposed routes, and that's something that would have to be developed as the plan is developed, but would likely include parts of Old County, Kelly and Main Street, between the site and Route 125.

If the main traffic was going out 121A towards

Hampstead, that would present another whole series of expenses and repairs, but the road that's going to be the primary road for truck traffic should be dealt with.

Second concern the board has is that the cleanup budget should also contain necessary funds to pay for special public safety details as needed for the cleanup. It's important, also, for us from a planning standpoint that before we begin a calendar year, we have some reasonable estimate of the anticipated hours of outside detail. Because of the budgeting process which we have to go through, set by the New Hampshire Department of Revenue Administration, we have to go gross budgeting. So although there would be revenue coming in to pay for the costs of special public safety details, we have to pay that out of our budget, so we need to know to budget ahead of time for that. So that would be important from a planning standpoint. Also important, as I said, that they be fully funded for the costs of those outside details.

Depending upon which routes were selected, there might be areas where you might need officers. There might be those where a current traffic light might suffice. But that kind of planning, we would like to be a part of and be involved in.

The third is that the town has a zoning ordinance that allows construction from 7 a.m. to 7 p.m., and in keeping with the residential neighborhood in which it's situated, we'd request that the EPA be sure that any firm, make it clear that they work within those restrictions. And while it's not part of the zoning, it would be reasonable to also restrict construction, so that it did not occur on Sunday, so that people were not being disturbed. Maybe shorter hours on Saturday or something. But somehow or other, to remember the residents of the neighborhood, so that they were not disturbed by this heavy construction that's going to be going on long term.

Fourth issue is the Fire Rescue Department would like to know materials, would like to have materials and instruction needed as to how to handle any type of emergency that might be related to the site cleanup.

The site cleanup will have some unique safety exposures for the people working there and we would like to be prepared, and we'll need some training, perhaps some equipment in order to be prepared.

Right now, we have no ability to handle trenching emergencies, shoring emergencies, confined spaces, they're beyond our current capability, so we would want to make sure that we had the necessary emergency preparedness. Also, of course, any MSDS sheets and other information that we might need to be prepared in case of an emergency.

The fifth issue was the Health Officer wants to be kept informed of issues that could impact health, including continuing to get water test results and just basically continuing what you've been doing. We've stayed on the immediate notification list, and we want to make sure that that Health Officer is kept informed of what is going on and any issues that might be arising that need specific attention.

Sixth, we request that adequate measures be taken so that truck hauling the contaminate soil do not track the contamination onto the roads. That would include, also, dust falling off or debris falling off. You know, when they load trucks, the little corners some times pick up pieces and then drop them off as they drive off.

I believe up at the Kingston site they were regularly cleaning the trucks thoroughly on one side of the road before they even crossed 125. And some method would need to be developed to cleanse the trucks before they left the site, and also make sure that they didn't have dust blowing off.

I mean, I've seen trucks that were covered that still spewed a lot of debris; and, naturally, we would not want any of that happening on the streets.

The last issue which I didn't have on the list but was mentioned, as I said, by Selectman Senter tonight, school buses.

As you can tell, we're in the immediate proximity of a school, and you would need to coordinate with the school bus transportation company and with school officials anything that would relate to the increased traffic, what was going to be going on in terms of what roads would need to be closed and what would need to be done about that.

Again, we thank you. We recognize there may be additional issues that arise. We appreciate the cooperation of DES and EPA at this point, and expect that that will continue.

Thank you for your cooperative work. There may be additional issues, but those are the ones that immediately come to mind.

Thank you.

THE HEARING OFFICER: Thank you, Mr. Scruton.

Anybody want to make a formal comment on the record this evening on the Beede Waste Oil Superfund Site Proposed Plan?

Please your hand.

Sir, step up to the podium, give your name, affiliation, and spell your last name if you need to.

MR. MOORE: Tim Moore from the Plaistow Planning Board.

We sent an e-mail through Mr. DiLorenzo a couple of days ago and we'll follow that up with a signed letter.

The Planning Board, in reviewing the plans, had the same comments that Mr. Scruton just made, particularly regarding the roads and traffic, if that could be perhaps reduced during school hours or commuter hours.

We also had a concern of when we might be able to actually start to use the site for other purposes. Would it be necessary to wait the full 15 years, until everything is clean, or is there some phasing that could occur during the time?

Our last concern was north of the site there are two junkyards which we know have polluted some wells north of the site, and I guess our question is: What should we do, we, being EPA, state and the town, to make sure that that activity or pollution gets cleaned up, because we certainly don't want to spend millions of dollars cleaning the soil, only to have it recontaminated by an upstream source.

So those are our concerns and, again, thank you for your cooperation and speedy work on what we've accomplished so far.

THE HEARING OFFICER: Thank you.

Anybody else in the audience who would like to make a formal statement this evening?

(Pause.)

THE HEARING OFFICER: Hearing none, I -- sir.

MR. GILL: Lawrence Gill, Conservation Commission. The questions I have are really directed to some of the proposed work that's being done.

One of the questions is: Why are the recharge wells located where they are, and what's the purpose of locating them there?

And the work that's associated with the restoration of Kelly Brook and the drawing of water from that, how will that affect wildlife, wetlands downstream of that?

Reading the proposal here, I believe there are some indications that you may discharge directly to the brook, and I'd like to know a little bit more about how that would be done, how much would be done; and, again, looking at impact downstream as you're pulling all of that water out?

THE HEARING OFFICER: Thank you.

Ma'am, please step up.

MS. CORKERY: Thank you. My name is Cathy Corkery. I'm with New Hampshire Sierra Club. I came down from Concord today to applaud the efforts of the community here in Plaistow and the leaders for not compromising and for going the extra mile to ensue that their water is drinkable and that the Kelly Brook is cleaner than it is today.

And I'm really encouraged by DES and the EPA for all the work and the proposal that they have here today, because one of the first things Jim said was, we won't stop until all of the oil is out. And that's really encouraging.

So I just want to further urge you and to keep on with the goals that you have set for us, and to remember that our priority today is to restore clean drinking water and to clean Kelly Brook for safe recreation, and so we don't have to worry if our dogs jump into the brook, if they're going to be okay or not.

And, lastly, Plaistow deserves clean drinking water, clean water from the tap, and no matter if you're a permanent long-time resident, a seasonal vacationer, native New Hampshire person or a non-native Granite Stater, it's what we deserve, and I want to, again, applaud the community leaders here.

Thank you.

THE HEARING OFFICER: Thank you, Cathy.

Anyone else want to make a formal statement this evening?

Sir.

MR. BANASKI: My name is Frank Banaski. I'm an abutter to the site. I just want to applaud the efforts that the EPA is doing here for the site, and I want to remind everybody that this site is zoned residential, and for any companies that the EPA decides to bring in at a future date to clean this site, that they have to be reminded that since this is a residential site, that it's got to be cleaned to the standards of a residential site and not to a brown site.

We want to have foremost in mind that this is not going to turn into a brown site where the contamination is left there for future years to contaminate the abutters.

Thank you very much.

THE HEARING OFFICER: Thank you very much.

Anyone else before I close the hearing?

Hearing none, I want to thank you very much for the statements this evening and for listening to the presentations that Jim has given you.

I remind you, we are in a public comment period on the proposed plan. It ends August 18th. Please submit written comments postmarked by the 18th or by e-mail to Jim. And if you have any questions on how to comment, there's a poster board over there.

Thank you for coming this evening, and we'll hang around and answer any other questions you may have.

Appreciate your night.

Thank you.

(Whereupon the hearing was concluded at 8:05 p.m.)

CERTIFICATE OF REPORTER AND TRANSCRIBER

This is to certify that the attached proceedings before: U.S. ENVIRONMENTAL PROTECTION AGENCY in the Matter of:

PUBLIC HEARING:

RE: BEEDE WASTE OIL SUPERFUND SITE

LOCATED IN PLAISTOW, NEW HAMPSHIRE

Place: Plaistow, New Hampshire

Date: July 17, 2002

were held as herein appears, and that this is the true, accurate and complete transcript prepared from the notes and/or recordings taken of the above entitled proceeding.

Suzanne French Reporter	July 17, 2002 Date
Norton Beecroft Transcriber	July 30, 2002 Date

PART 3

RESPONSIVENESS SUMMARY
BEEDE WASTE OIL PROPOSED PLAN (June 2002)

December 2003

Introduction

The United States Environmental Protection Agency Region I ("EPA") issued a Proposed Plan for final cleanup of the Beede Waste Oil Superfund Site ("Site") in June 2002. An informational meeting was held on June 26, 2002, followed by a public hearing on July 17, 2002. A sixty (60) day public comment period was held from June 19 to August 18, 2002. Since August 18 was a Sunday, EPA accepted written comments post-marked by August 19. Written and verbal comments were received from community members, potentially responsible parties ("PRPs") and other interested parties.

Purpose

All comments received on the Proposed Plan were considered as EPA prepared the Record of Decision ("ROD") which specifies the final cleanup plan to be implemented at the Site. The purpose of this Responsiveness Summary is to document EPA responses to all comments raised and explain how or why concerns and suggestions were or were not incorporated into the ROD. This Responsiveness Summary provides a complete listing of all comments received. Since numerous and somewhat lengthy comments were received, they have been grouped, where possible, into common issues and concerns to allow EPA to respond more effectively.

A complete copy of the individual comments received is attached as Appendix A. A copy of the transcript from the public hearing is attached as Appendix B.

Overview

Commercial operations, including recycling of used oil and storage and distribution of virgin fuel oil, reportedly started in 1926 at the site. Other waste handling operations conducted at the site included gasoline/water separation, cold-patch asphalt batching of petroleum-contaminated soils, used antifreeze recycling, oil burner repair and solvent distillation. In the fall of 1992, Beede Waste Oil and Cash Energy, Inc. discontinued operations at the property. Tri-State Resources, a virgin fuel oil distribution business, operated at the property as a tenant from the Fall of 1992 until August 1994 when all business operations at the property ceased.

In June of 1996, the Site was proposed for placement on EPA's National Priorities List ("NPL") of hazardous waste sites which would make it eligible for Federal funding for investigation and cleanup under the Superfund program. The Site was finalized on the NPL in December of 1996.

From July 1996 to August 1997, EPA removed approximately 110,000 gallons of oil/hazardous liquid, 200 tons of hazardous sludge, 235,000 gallons of hazardous waste water from above ground storage tanks and 303 drums. Between November 1996 and January 1998, the New Hampshire Department of Environmental Services ("DES") removed approximately 160,000 gallons of used oil, 490,000 gallons of wastewater, 100,000 gallons of sludge, 850 tons of scrap steel and 600 drums. This joint effort resulted in the removal of all known stored liquids and tanks from the Site. Under a non-time critical removal action, EPA completed construction of a vacuum-enhanced extraction system in February 2000 to remove contaminated oil floating on the groundwater. A 120 foot long oil interceptor trench was also installed along Kelley Brook, which eliminated ongoing seepage of oil into the brook. As of June 2003, the extraction system has recovered more than 75,000 gallons of contaminated oil for off-Site disposal.

Concurrent with the above removal actions, under a Cooperative Agreement with EPA, DES performed a remedial investigation and feasibility study which concluded in January 2002. The study documented significant levels of contamination in soil and groundwater, estimated current and future human health and ecological risks and evaluated a series of source control and management of migration remedial alternatives.

In June 2002, EPA released a Proposed Plan for comprehensive cleanup of the Site.

Summary of the Proposed Cleanup Plan

EPA's proposed cleanup plan was a comprehensive remedy developed through consideration of six source control ("SC") and four management of migration ("MOM") alternatives as presented in the Feasibility Study ("FS"). SC alternatives ranged from no action to capping to full on-site or off-site treatment and disposal. MOM alternatives ranged from no action to monitored natural attenuation to full-scale pump and treat systems.

The preferred remedy was a combination of the SC-5 and MOM-3 alternatives as follows:

- Excavation and off-Site disposal of all contaminated soil (about 85,000 yds^3) to a depth of ten feet, as necessary, and including all soil piles and a limited sediment area;

- Installation of a vacuum extraction system, possibly thermally enhanced, for deeper soils (about 30 feet) to remove VOCs from residual non-mobile non-aqueous phased liquids; and

- Installation of a groundwater extraction and treatment system designed to pump at 85 gallons per minute (200 gallons per minute capacity) through seven on-Site extraction wells and forty on-Site recharge galleys.

General Reaction to the Preferred Remedy

Comments received in response to the Proposed Plan differed by stakeholder group. Community members and local government officials expressed support for the preferred remedy. The concerns this group raised were related to off-site activity during performance of the remediation, i.e., Site access, traffic control, and local infrastructure maintenance. Some PRPs raised several procedural, policy and technical concerns with the proposed remedy. The procedural and policy issues raised objected to the anticipated residential future use of the Site, which was an important factor in developing cleanup standards and alternatives in the FS. These PRPs requested that EPA provide the Town of Plaistow with a grant to study reuse and to development a community plan for the Site. These PRPs also identified technical issues with the proposed groundwater extraction and treatment system and believe that aquifer restoration may not be possible.

Written Comments List *(by name and affiliation in no particular order)*

Robert J Capuzzielli
Bob's Citgo

Richard Manley
Wakefield Auto Service Inc

Alan Doherty
Everett Transmission

John Scruton, Manager
Town of Plaistow

Tim Moore, Chairman
Planning Board
Town of Plaistow

Roy P. Giarrusso
Giarrusso, Norton, Cooley & McGlone, P.C.
Waste Management

John V. Dwyer, Jr.
Winer and Bennett LLP
ExxonMobile Corporation

Beede Superfund Site Ad Hoc Steering Committee
Group of Twenty Two (22) PRP Attorneys

Robert F. Fitzpatrick Jr.
Hale and Dorr LLP
Massachusetts Electric Company and New England Power Company

Verbal Comments List - July 17, 2002 hearing *(by name and affiliation in no particular order)*

Jeff Rose
Senator Bob Smith's Office

John Scruton, Manager
Town of Plaistow

Tim Moore, Chairman
Planning Board
Town of Plaistow

Lawrence Gill,
Conservation Commission
Town of Plaistow

Cathy Corkery
Sierra Club
Concord, New Hampshire

Frank Banaski
resident/abutter
Town of Plaistow

EPA responses to comments are grouped as follows; common non-technical issues raised by multiple commentors are addressed by subject area (Superfund liability, infrastructure, and future land use); and technical issues raised by commentors are responded to individually.

All EPA responses are written in **bold** text.

Common Issues

I. *Superfund Liability Concerns* *(Robert J Capuzzielli, Richard Manley, Alan Doherty)*

Three commentors, as identified above, raised concerns regarding Superfund liability. As generators of hazardous waste (in this case waste oil) to the former Beede Waste Oil Company facility, they have been designated as potentially responsible parties ("PRPs") who, along with approximately 2,000 additional PRPs, are required to help finance the Site cleanup. These parties feel that this financial responsibility more appropriately rests with the federal and/or state governments who either recommended use of the former facility or who should have prevented the release of contaminants during the facility's operational history. They further share the view that it is wrong for them to be held financial responsible since they complied with all the appropriate disposal regulations.

While the commentors' concerns do not specifically address technical matters contained in the *Proposed Plan*, their comments were clearly submitted in response to EPA's release of the *Proposed Plan*, were received during the public comment period, and raise basic questions about Superfund liability at Beede.

The Superfund Law and Beede

The Superfund law (the Comprehensive Environmental Response, Compensation and Liability Act or "CERCLA" at 42 U.S.C. Section 9601, et. seq.), **enacted by Congress in December 1980, created a program to identify and cleanup sites at which a release of hazardous substances, pollutants and contaminants into the environment has occurred or is likely to occur.**

To achieve clean up under the Superfund law, EPA is required to seek participation in the clean up of sites like Beede by parties that are identified as being liable under the law. Section 107(a) of CERCLA imposes liability upon four classes of parties, including "any person who by contract, agreement, or otherwise arranged for disposal or treatment, or arranged with a transporter for disposal or treatment, of hazardous substances owned or possessed by such person...." 42 U.S.C. § 9607(a)(3). Parties that fall within this class are commonly referred to as CERCLA "generators" or "arrangers." The generator of a waste may not necessarily be the person who actually produced the waste. When a dealer or shop owner removed waste oil from a storage tank and arranged for its disposal, if that waste oil went to the Beede Site, under CERCLA that person is a generator at the Beede Site.

Federal courts have consistently agreed that Congress intended for CERCLA to be a "strict liability" statute. This means that a person (including a business) that is a "generator" under CERCLA is liable for cleanup costs at the disposal site regardless of the generator's fault or intent to transport waste to and/or dispose of it at a specific site. Thus, a generator's good faith belief that its waste is being properly handled and disposed of by a transporter is not a defense to liability.

Second, Congress made CERCLA liability retroactive. Therefore, a party may be liable for cleanup costs under CERCLA based upon disposal of hazardous waste that occurred before CERCLA was enacted. A party can be liable even if the waste disposal was legal and conformed to industry standards when the disposal occurred. Third, CERCLA liability generally is "joint and several." Accordingly, a single party may be liable for all response costs incurred by the government without regard to the government's ability to pursue other potentially responsible parties ('PRPs").

The Agency has no legal authority to create another liability scheme. EPA, however, has established policies to mitigate the potentially severe impacts of CERCLA liability under certain circumstances. In this case, there are many generator PRPs because waste oil recycling facilities operated at the Beede Site over a long period of time. Being identified as a PRP at the Beede Site does not necessarily imply fault or misconduct. Superfund requires EPA to identify responsible parties to perform and finance the cleanup of the Beede Site.

<u>**History of State and Federal Involvement at Beede**</u>

With respect to government regulation prior to site closure in 1994, it is important to note that the Beede Waste Oil Company operated as a waste oil recycler under New Hampshire law beginning in the early 1980s. Because the Beede Waste Oil

Company registered as a waste oil recycler with the State, it was not subject to federal regulation for the handling and storage of hazardous materials, and there was no regulatory mechanism for federal oversight of Site activities under federal law.

II. *Infrastructure Concerns* *(John Scruton, Tim Moore)*

Both the Town Manager and Planning Board Chairman submitted comments on behalf of the Town of Plaistow. While the Town generally supports EPA's *Proposed Plan,* several specific infrastructure concerns were raised as set forth below.

- *Road Repairs* - The Town requested replacement of local roads prior to the start of the cleanup and that funds be reserved to repair any damage to the roads following remedy completion.
- *Public Safety Details* - The Town requested that the cleanup budget include funds to pay for special public safety details at busy intersections.
- *Hours of Work* - The Town noted that the Site is located in a residential area in which hours of construction activity are restricted by local ordinance and requested that the timing of construction activities be limited.
- *Fire Rescue Department* - The Town has provided notice that Site emergencies related to trenching, shoring, and confined spaces are beyond the current capability of the fire rescue department. The department request copies of all material safety data sheets ("MSDS") and other information to prepare for Site emergencies.
- *Health Officer* - The Town has requested that the Health Officer continue to be kept informed of issues that could impact public health, including continuing to receive water test results and remaining on the immediate notification list.
- *Decontamination* - The Town expressed concern that adequate measures be taken to ensure that the trucks hauling the contaminated soil off-site do not "track" contamination onto the roads, generate excessive dust or have debris falling off.

As part of the pre-remedial design process, and throughout remedy implementation, the performing parties[1] will address the infrastructure concerns identified above, as appropriate. The performing parties will coordinate with the Town under EPA supervision and comply with off-Site rules and requirements, i.e., DOT regulations,

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[1]EPA expects the cleanup to be performed by PRPs under close supervision by EPA and in compliance with federal and state requirements.

local ordinances, and emergency response. The Town's concerns will be considered in cleaning up the Site as specified in the ROD. It is EPA's goal to ensure public safety and minimize impacts to the local community.

Note that MSDS data sheets will be provided to the local fire rescue department and data from supply wells will continue to be sent to the local health officer. During performance of the remedy, trucks leaving the Site will be decontaminated as part remedy implementation.

III. *Residential Clean Up Standards and Future Land Use at the Site* *(John V. Dwyer, Jr., Roy P. Giarrusso, Beede Superfund Site Ad Hoc Steering Committee)*

Three commentors, as identified above, raised concerns regarding the residential clean up standards relied upon for remedy selection. A majority of these comments concern EPA's current land use assessment and future land use assumptions. In summary, the commentors question whether EPA's expectation that the Site will be used residentially in the future is based on actual knowledge or realistic assumptions. The commentors assert that residential use is not a reasonably anticipated future use under Agency guidelines. One commentor declares that residential use is contrary to statements about possible land use by local officials. Two commentors request that the Site be re-zoned for open space, recreational use or "clean" industrial use. The commentors all strongly agree that EPA should consider the results of any Town reuse planning for the Site prior to final remedy selection. The commentors recognize that future use of the Site will greatly influence certain aspects of remedy selection. All commentors agree that future use of the Beede Site is ultimately a local (Town) decision. Please refer to the actual text of the comments for more detail.

EPA carefully considered land use, zoning requirements and Site character, along with reasonably anticipated future land use, in determining that remedy selection must be protective of human health and the environment at a residential level. In other words, the reasonably foreseeable likelihood that portions of the Site will be used for residential living drives basic risk exposure assumptions in remedy selection. EPA believes that the selected clean up remedy for the Beede Site, presented in the Proposed Plan, and finally in the Record of Decision, must be implemented in order to fully protect current residents, workers, and neighbors, as well as future residents and future recreational users of the Site from the risk of exposure to hazardous substances on the land, in Kelley Brook and in the groundwater.[2]

[2] Note that, in EPA's opinion, the reasonably anticipated future residential use of the Site is <u>not</u> driving the need to restore groundwater to drinking water standards. Cleanup goals for groundwater are established by federal and state applicable and relevant or appropriate

Consideration of reasonably anticipated future land use in remedy selection under Superfund helps in the development of practicable and cost-effective remedial alternatives. In May 1995, EPA issued a directive titled "Land Use in the CERCLA Remedy Selection Process." This guidance sets forth a proposed process for assessing reasonably anticipated future land use when making remedy selection decisions, and stresses the importance of community input. EPA consulted this guidance, and land use assumptions for the Beede site were made after careful and thorough consideration of all relevant information.

In determining the appropriate level of risk exposure for land use upon which remedy selection relies, EPA carefully considered a number of factors primarily related to current and reasonably foreseeable future use of the Site. EPA's evaluation specifically included consideration of not only the character of the neighborhood, ownership of the Site and land use zoning, but also the Town of Plaistow's Motions of the Board of Selectmen dated May 12, 2003.[3]

Included in the May 12 Motions of the Board is support for a reuse plan that includes senior housing, a community center, recreational fields, development of an interim off-Site water source, eventual Town ownership or control over the property, and construction of a bridge over Kelly Brook.[4] EPA's analysis of all information relevant to land use and land use planning mandates that only a residentially based clean up will fully protect human health and the environment for the reasonably anticipated future use of the Site – mixed residential and recreational.

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requirements ("ARARs"). The rationale for groundwater clean up standards is discussed further in the "Technical Concerns" section of this Response to Comments.

[3] The comments addressed in this section of the Responsiveness Summary include statements supporting EPA consideration of the Town of Plaistow's application to receive an EPA pilot grant for reuse assessment. A grant was awarded to the Town of Plaistow in the fall of 2002, and, consistent with the terms of the grant agreement, the Town established the Beede Waste Oil Reuse Committee. This committee engaged in reuse planning process for the Beede Site, which culminated in the May 12, 2003 Motions of the Board of Selectmen (accompanied by an explanatory letter addressed to the Town Board from the Beede Waste Oil Reuse Committee, also dated May 12, 2003). The EPA grant to the Town did not dictate a particular result, and EPA considers reuse planning for the Site to be within the sole discretion of the Town.

[4]The Motions of the Plaistow Board of Selectmen did not conclude exactly where the housing, recreational fields and community center would be built on the Site, although they did express a general preference for development in accordance with one of two schematic options referenced in the Motions.

In gathering information relevant to land use, EPA communicated with local officials and community members throughout the remedial investigation and feasibility study ("RI/FS") process. Discussions regarding land use were held with the Plaistow Board of Selectmen in numerous public sessions from 1996 to 2002. In 1997, the Town voted to change local zoning for the area that includes the Beede Site. The zoning for both Parcels 1 and 2 of the Site were changed to medium density residential ("MDR 20"). Thereafter, the Board of Selectmen repeatedly expressed interest in making certain that future use of the Site would be in compliance with the local zoning ordinance. In addition, the Board expressed interest in taking the property through tax foreclosure. The following summarizes the major considerations in concluding that a residentially-based clean up is both appropriate and necessary for the Beede Site.

- **The current zoning of the Site is residential (MDR 20 zoning[5]);**
- **Communication between EPA and the community (including the Town government) which favored mixed residential and recreational uses for the Site;**
- **The majority of existing abutting properties are residential;**
- **The Plaistow Board of Selectmen expressed intent to gain control of the property;**
- **The plans for future Site use detailed in Motions of the Board of Selectmen on May 12, 2003, and the accompanying letter to the Board from the Beede Waste Oil Reuse Committee;**
- **Limited accessibility of the property for uses other than residential; and**
- **The anticipated future growth rate of the town.**

IV. *Technical Concerns* *(John V. Dwyer, Jr., Roy P. Giarrusso, Beede Ad Hoc Steering Committee, Lawrence Gill)*

Various technical aspects and requirements contained in the Proposed Plan have been questioned by each of the above-noted commentors. The detailed nature of these comments requires that each issue be addressed independently. Therefore, the following responses to technical issues are listed by commentor.

D. *John V. Dwyer, Jr. (ExxonMobile) Comments*

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[5]With respect to zoning, note that although the Town MDR 20 zoning designation does not require that construction of single family homes is the only use for the property, this zoning designation, combined with a clear indication by the Plaistow Town government that residential housing is an anticipated (planned for) use of the Site, contributes to EPA's conclusion that residential housing is a reasonably foreseeable (likely) future use of the Site.

1. With regard to determining the leaching of contaminants from Site soil, the commentor states the following:

> "... the empirical model chosen to achieve the goal (limit the leaching of contaminants from soil) is currently unsupported and results in cleanup requirements that are more stringent than the conservative New Hampshire Risk Characterization and Management Policy ("RCMP"). The Proposed Plan suggests that available models are all inapplicable because they were not developed to reflect leaching of contaminants from waste oil. The comment appears to ignore the fact that the current non time-critical removal action ("NTCRA") is specifically designed to address non-aqueous phased liquid ("NAPL") recovery, resulting in significant source remediation and enhancing the ongoing biodegradation process. Upon completion of that remedial phase, it is very likely that existing soil leachability models could be applied to the Site, based upon removal of source area mass and an updated assessment of groundwater quality and residual source area contaminant levels."

The commentor includes a table which displays the RCMP Method 1 standards for several volatile organic compounds ("VOCs") of concern against the Proposed Plan soil cleanup goals, as determined by the empirical model, and notes that the results from the empirical model are lower in each case. The commentor suggests that these results are a good indicator that the model is not accurately representing the physio-chemical process, and concludes that the remedy has been chosen prematurely.

EPA believes the Site-specific model developed in the FS most accurately predicts the on-Site leachate potential of VOCs in soil.

Standard soil leaching models (such as the model used to develop the RCMP Method 1 standards) assume VOCs are absorbed to soil particles. These models are not applicable to conditions at the Beede Site because VOCs tend to absorb to residual NAPL product, rather than soil particles. Additionally, the RCMP Method 1 standards are not ARARs at this Site.

The Site-specific leaching model which EPA applied is actually a 'leaching test' which uses actual soil and groundwater data to develop a ratio of concentrations. The resultant ratio is then used to determine cleanup goals in soil based on anticipated exceedances of ambient groundwater quality standards.

Further, EPA's consultant verified that the cleanup goals generated through application of the Site-specific model are more applicable to the Site conditions than the RCMP Method 1 standards (see Appendix H). The Site-specific model is more accurate because it relies on actual Site observations, conditions and data rather

than general assumptions made in the RCMP. For example, the Site-specific model takes into account the actual observed concentrations for the multiple source areas present at the Site, whereas the RCMP is based on an assumed initial soil concentration of 10 ppm for each observed contaminant released from a single source. Also, Site conditions have not, and will not change as a result of the ongoing NTCRA. The goal of the NTCRA is to remove *mobile* NAPL only. Residual NAPL will remain post-NTCRA which will contain absorbed VOCs.

2. The commentor believes a phased approach to groundwater cleanup is warranted for the following reasons; to allow the Town adequate time to fully explore future Site use; to allow complete removal of the NAPL under the NTCRA; and to encourage establishment of a long-term alternate water supply system for affected adjacent property owners and future users at the Site. The commentor believes that is technically impracticable to restore the affected aquifer due to known off-Site sources and the potential for dense non-aqueous phased liquid ("DNAPL"). Consistent with a phased approach, the commentor suggests the groundwater RAO should be viewed as four separate goals;

> "(1) limit migration of contaminants in groundwater beyond the current plumes, (2) achieve drinking water quality standards in all off-Site wells currently impacted by the Site, (3) provide an interim water supply to the Site, and (4) ultimately, achieve drinking water standards throughout the Site if it is technically practical to do so."

The Town has completed it's evaluation of reuse options for the Site. Although attainment of NTCRA goals may impact the schedule for implementation of final remedial actions, modification of the groundwater RAOs to reflect a phased approach is not warranted. Note that all RAOs, including groundwater RAOs, were re-worded to be more consistent with EPA guidance[6] as follows;

- **<u>For Protection of Human Health</u> - Restoration of groundwater to drinking water standards, or in the absence of such standards, to health-based action levels.**

- **<u>For Protection of Human Health</u> - Containment of the contaminated groundwater plume to prevent further migration.**

- **<u>For Protection of Human Health and Ecological Receptors</u> - Reduction of contaminated groundwater discharge to Kelley Brook to prevent degradation of sediment and surface water quality.**

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[6]A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, July 1999.

The commentor's suggestion that the existing RAOs for groundwater should be viewed as four separate goals is not consistent with the priority to restore the aquifer to drinking water standards. Also, the presence of an interim or temporary water supply to the Site has no bearing on the planned RAOs and does not replace the overall goal of restoring groundwater to drinking water standards. EPA does recognize the complexities of restoring groundwater quality to drinking water standards, however Site data demonstrates that it is practical to do so in a reasonable time frame if performed in conjunction with successful source control measures. Off-Site sources will not effect performance of the groundwater remedy since they are not interacting with on-Site plumes.

There is currently no evidence of free-product DNAPL anywhere at the Site.

3. Consistent with comment 2 above, the commentor suggests that a phased approach to groundwater remediation would allow the stockpiled soils to be removed sooner and for enhancement of the current NTCRA system to address continued migration of the Site plumes.

A phased approach to groundwater remediation is not appropriate to remove the stockpiled soils or enhance the NTCRA, as explained below.

The existing Proposed Plan requires removal of all stockpiled soils as part of the larger source control response. The piles are currently covered to prevent dispersion of the contaminated soil particles and to minimize leachate. Many are located on top of highly contaminated surficial soils. Removal of the stockpiled soils, prior to addressing surficial soil contamination, will result in cross-contamination.

The NTCRA system was specifically designed as a source control measure and, in fact, attempts to minimize groundwater recovery since on-Site treatment and disposal options for groundwater do not exist. Enhancement of the NTCRA system is not necessary since the groundwater remedy, as proposed by EPA, will eliminate plume migration in a reasonable time frame. In the interim, off-Site receptors are adequately protected through aggressive monitoring and installation and maintenance of point-of-use treatment systems, where necessary.

4. The commentor suggests that EPA's RAO for groundwater be modified as follows;

> "Limit and ultimately eliminate the discharge of contaminated groundwater to Kelley Brook <u>at concentrations that would result in unacceptable levels of risk</u>."

Modification of the groundwater RAOs is not appropriate. Note that all RAOs, including groundwater RAOs, were re-worded to be more consistent with EPA guidance. The specific RAO for groundwater referenced by the commentor is now as follows; Reduction of contaminated groundwater discharge to Kelley Brook to prevent degradation of sediment and surface water quality.

Sediment and surface water quality in Kelley Brook has been degraded by releases from the Site. The ongoing discharge of contaminated groundwater from the Site plumes is a contributing factor to the degraded quality. Potential human health risks resulting from ingestion of fish and direct contact or ingestion of sediment in Kelley Brook are present. The eventual elimination of contaminated groundwater discharge from the Site plumes to Kelley Brook will reduce elevated risks.

Required Restoration of the aquifer to drinking standards is driving the need for active groundwater remediation. Reduction and eventual elimination of contaminated groundwater discharge to Kelley Brook is an added benefit.

5. The commentor suggests that the Proposed Plan does not adequately portray the impacts of each alternative on workers and residents. The aesthetic and economic impacts to the community in returning the Site to productive use have been underestimated.

While aesthetic and economic impacts are important considerations, EPA is required to evaluate nine specific criteria in recommending an alternative. Community acceptance is one of these criterion.

Page 6 of the Proposed Plan does highlight the potential community impacts resulting from implementation of the recommended alternative. Further, the evaluation of alternatives discussion on pages 10 and 11 briefly address the relative impacts for each alternative.

6. The commentor believes that alternative SC-3 was prematurely rejected. SC-3 should remain under consideration until the town selects an actual reuse for the Site.

EPA eliminated alternative SC-3 (i.e., capping) because it is not protective of human health for the reasonably anticipated future use of the Site, it may not be protective of ecological health due to the presence of burrowing mammals, and is inconsistent with the Town's recently approved reuse plans for the Site.

It is important to note that while source control alternative SC-3 was eliminated from further consideration primarily because it does not allow for residential use, SC-3 is also not necessarily compatible with recreational or municipal uses. SC-3 is

a trespasser scenario. It essentially assumes that the Site remain fenced with public access restricted.

7. The commentor believes that alternative MOM-4 was prematurely rejected since it achieves the same goals as MOM-3 and the ability to attain desired goals within the 15 year time frame specified for MOM-3 in the Proposed Plan is questionable.

 EPA maintains that MOM-3 is the appropriate alternative since it will restore the aquifer to drinking water standards in about half the required time of MOM-4. The higher pumping rate associated with MOM-3 will also result in a reduction in the mobility, toxicity and volume of groundwater contamination much quicker than MOM-4 and restore drinking water quality to impacted residents in the shortest time frame.

 While MOM-3 is estimated to extract groundwater at 85 gallons per minute, the final pumping rate will be determined during pre-design studies. However, the overall goal of MOM-3 will remain to restore the aquifer to drinking water standards within 15 years.

8. The commentor suggests that natural attenuation may already be occurring and that the age and limited number of sampling events do not provide sufficient data to fully understand and support the selected remedial alternatives.

 Natural attenuation of downgradient portions of the plume is an integral part of MOM-3, but alone is not sufficient to restore groundwater quality in a reasonable time frame. Complete source removal and active groundwater remediation, in conjunction with ongoing natural attenuation processes, are necessary to restore groundwater quality.

 EPA believes that the level of soil, groundwater and sediment data is comprehensive and appropriate for making remedial decisions. During the remedial investigation, over 200 individual soil and sediment data points were collected. Nearly 60 monitoring wells were installed and sampled for multiple targets. All the data met or exceeded rigorous EPA Region 1 standards for quality control and validation.

 The data set continues to be updated by the annual monitoring of approximately 40 residential wells, which has been performed since 1995. An additional 40 on-Site monitoring wells were sampled in 1998, 1999, 2000, 2001 and 200.

9. The commentor suggests that an alternate water supply would allow for Site reuse in a more timely manner and that this approach should not have been eliminated from the FS.

The development of an alternative water supply may be required as an interim measure until the groundwater remedial goals are achieved, but is not a substitute for the need to restore the aquifer to drinking water standards. Several adjacent residential supply wells have already been impacted by contaminants above federal and state drinking water standards. Point of use treatment systems have been used as temporary solutions to provide potable water. Aquifer restoration is a necessary and permanent solution to prevent further exposures and ongoing migration.

10. The commentor suggests that existing (off-Site) bedrock supply wells should be sealed and replaced with deeper wells to prevent further drawing of contaminants into the bedrock.

The installation of deeper bedrock supply wells is not an acceptable substitute for restoration of this "High Value" aquifer.

Existing contaminated bedrock wells are approximately 300 feet deep. Although water bearing fractures are discernable, it is difficult to determine which fractures would or would not transport contaminants from the Site. The area is highly fractured and it is possible that contamination already exists in the deeper fracture network. Point of use treatment systems are a proven method to provide safe potable water for existing well users until the aquifer is restored to drinking water quality.

B. *Roy P. Giarrusso (Waste Management, Inc.) Comments*[7]

1. The commentor believes the proposed targeted soil cleanup levels, which are based on residential use, are not appropriate given the past industrial use of the Site. The commentor believes that soil cleanup levels should be appropriate for risk-based closure in conjunction with the agreed upon beneficial 'future' use of the Site.

Land-use is a local decision, not an EPA decision. The reasonably anticipated future use of the Site is residential and not industrial.

EPA developed risk-based soil cleanup levels based on the reasonably anticipated future use, as required by EPA policy, among other considerations which are presented in Part II of the ROD.

[7]Waste Management, Inc. also incorporates by reference comments submitted on behalf of ExxonMobile.

2. The commentor believes that the proposed 'dredging' of a portion of the Kelley Brook wetlands is not consistent with the ecological risk assessment. The commentor requests that EPA revise the proposed sediment cleanup standards.

   Sediment removal from the former oil breakout area is necessary to address excess risk to trespassers and fisher-persons (consistent with the human health risk assessment), and to remove an ongoing source of surface water contamination (consistent with the ecological risk assessment). EPA developed risk-based cleanup standards for sediment which will allow for residual levels of PCBs and other contaminants to remain in concentrations that are safe for trespassers and will not bioaccumulate to excess levels in fish tissue.

3. The commentor suggests that thermally enhanced SVE is not a well established technology. Further, the commentor believes that the required lowering of the water table for SVE will require prolonged operation to reach cleanup levels in groundwater. The commentor is also concerned that thermally enhanced SVE will require the removal of the 143 wells associated with the ongoing light non-aqueous phased liquid ("LNAPL") recovery system. The commentor recommends that the SVE system be replaced by a dual-phased extraction system to remove VOCs from the residual product, deep soil and groundwater.

   VOCs are an ongoing source of groundwater contamination which must be removed to effectively restore groundwater. SVE is an effective technology for the in-situ removal of VOCs in soil.

   VOCs tend to absorb to residual oil product rather than soil particles. Thermal enhancement of the SVE system through steam injection may be necessary to supply sufficient energy to cause the VOCs to desorb from the residual oil product.

   However, as stated in the Proposed Plan, EPA recommends the performance of a field study as part of the pre-design process to determine the need for, and/or the extent of, thermal enhancement. If EPA determines that the field study does not support thermal enhancement, some of the 143 wells and other components of the existing LNAPL removal system may be utilized for the SVE system.

4. The commentor recommends implementation of source control alternative (SC-3) for the removal of soils and the capping of the existing landfill area. The commentor believes that sediments from Kelley Brook should be left in place.

   The SC-3 alternative (i.e., capping) is not consistent with the reasonably anticipated future residential use of the property. SC-3 would not be protective for a residential cleanup and may not be protective for a recreational cleanup.

The landfill must be removed since it is located in a wetland and does not meet the state's landfill citing and closure regulations. The Wetland Executive Order will require EPA to mitigate impacts to wetlands in the landfill area. Contaminated sediments from the former oil breakout area present an unacceptable human health risks and must be removed.

5. The commentor disagrees with active plume remediation. The commentor prefers a pump and treat system to effectuate hydraulic control to prevent further off-Site migration of the plume, particularly in the northeastern portion of the Site where potable wells have already been impacted. The plume would then be allowed to attenuate on-Site. Point-of-use treatment systems would be maintained.

Given that the aquifer is the only source of drinking water in the Town of Plaistow, active aquifer restoration must be undertaken.

The commentor's recommendation is a modification of the limited action MOM-2 alternative (i.e., natural attenuation) presented by EPA in the Proposed Plan. Alternative MOM-2 was not selected because the time frame estimated for natural attenuation to achieve drinking water standards is approximately 40 years (with effective source control) and does not satisfy the threshold criterion under the NCP to protect public health *and* the environment. This time frame is unreasonable and inconsistent with the State's designation of the aquifer as a "High Value" source of drinking water. Active treatment is anticipated to restore the aquifer in as little as 15 years and drinking water quality to impacted residents in as little as 5 years.

The Proposed Plan includes natural attenuation for the more dilute areas of the plume (i.e., SWRP 1 plume and down gradient areas of the plume which discharge to Kelley Brook). EPA agrees that point-of-use treatment systems must be maintained to provide potable water until aquifer restoration efforts are successful.

6. The commentor proposes biological remediation for treatment of immiscible product and VOCs in the smear zone. The commentor believes this technology is proven effective and does not require lowering of the water table. Biological remediation would continue until the source area petroleum and related VOCs are removed. Metals would be controlled through containment pumping.

VOCs are the only contaminate of concern in the LNAPL smear zone since they continue to leach to groundwater. Timely and effective removal of VOCs is necessary for subsequent restoration of the aquifer. Biological remediation for the removal of VOCs from the smear zone is not recognized by EPA as a proven technology.

C. *Beede Ad Hoc Steering Committee Comments*

1. The commentor believes the use of residential standards is not appropriate for the Site and requests that the property be re-zoned as non-residential.

   See response IV.B.1 above.

2. The commentor requests implementation of a soil remedy that includes on-Site consolidation, stabilization, capping of higher impacted soils, excavation and off-Site disposal of limited soils, as required, and placement of a soil cover over a majority of the soils. Institutional and access controls would be implemented.

   Capping and covering the contaminated soil on-Site is inconsistent with the reasonably anticipated residential future use of the property. It is important to note that effective source control measures which involve removal or treatment of contaminants will facilitate subsequent groundwater cleanup and are necessary to achieve successful aquifer restoration.

3. The commentor requests that EPA, "Recognize the technical impracticability of restoring groundwater to drinking water conditions." The commentor recommends alternatives which focus on containment and risk management, such as slurry walls and institutional controls.

   EPA disagrees with the commentor regarding the technical practicability of restoring groundwater to drinking water standards. Pump and treat technologies are proven and effective methods for the removal of contaminants from groundwater.

   EPA does recognize the complexities of restoring groundwater quality to drinking water standards, however, Site data demonstrates that it is practical to do so in a reasonable time frame if performed in conjunction with successful source control measures.

4. The commentor requests that EPA;

   > "assess in more detail the rate of natural cleanup of the sediments,"

   reserving the implementation of selective sediment removal only in the event that natural cleanup is not occurring and residual levels pose public health or environmental risk.

   Contaminated sediments from the former oil breakout area present an unacceptable human health risk and must be removed.

The sediments targeted for removal are saturated with petroleum hydrocarbons, contain PCBs and metals, and have been identified by the ecological risk assessment as an ongoing source of surface water contamination. These contaminants are immobile and located in an area of low flow, therefore natural cleanup is highly improbable. Removal of this targeted sediment area should be performed in conjunction with the adjacent soil removal to minimize overall disturbance to this wetland area.

5. The commentor requests that EPA;

> "implement a reduced groundwater monitoring program from that proposed in the Plan that focuses on public health protection and the continuing evaluation of the effectiveness of the remedy."

The conceptual groundwater monitoring program included in the Proposed Plan was developed to ensure protection of public health and measure the effectiveness of the remedy. EPA will further assess the scope of the monitoring program during the design process, and require adjustments if necessary, to ensure that the plan cited in the ROD is consistent with these goals. EPA will continually assess the scope of the monitoring program throughout the remedial process to ensure consistency with monitoring goals.

6. The commentor believes that the Feasibility Study should have considered a series of source control options between alternatives SC-3 (i.e., capping) and SC-4 (i.e., total removal), including selective soil removal, on-Site disposal and thick soil caps. The commentor believes that on-Site disposal was incorrectly screened out due to a non-technical requirement of a 500 foot set-back; a requirement which the commentor believes was relaxed at other sites.

EPA believes that the FS was appropriately inclusive.

Several dozen soil remediation approaches, including capping, disposal and various treatment technologies were screened in accordance with EPA guidance. The resulting alternatives SC-1 through SC-6 include the four basic options of cleanup available as underlined: (1) SC-1 and SC-2 include <u>limited action</u>; (2) SC-3 includes <u>containment</u> of the waste under a cap; (3) SC-4 includes <u>off-Site</u> disposal; and (4) SC-5 and SC-6 include <u>on-Site</u> treatment and disposal options. On-Site disposal was initially screened out due the State of New Hampshire's 500 foot set-back requirement (Env-Wm 2504.04(c)). However, in the end, on-Site disposal was eliminated from further consideration because it is not consistent with a residentially based cleanup.

7. The commentor believes that MOM-2, limited action, does meet the threshold criterion of being protective of public health and the environment since it includes institutional controls and should have been rated as equally protective with the active treatment alternatives MOM-3 and MOM-4. The commentor further states that;

> "it is widely recognized that pump and treat systems do very little to restore aquifer water quality."

While EPA agrees that MOM-2, MOM-3 and MOM-4 must all rely on institutional controls as the primary means for protection of public health until drinking water quality is restored, MOM-2 is <u>not</u> protective of the environment because it would allow for the continued uncontrolled migration of contaminants into the Kelley Brook wetland system. With regard to the effectiveness of groundwater pump and treat systems, refer to response IV.C.3 above.

8. The commentor believes that other groundwater remedial measures, such as in-situ treatment techniques, containment systems and community water supply systems should have been considered in the final set of alternatives evaluated in the FS. The commentor believes that such measures have been frequently utilized at other Superfund sites. The commentor suggests the extension of a water line from a municipal water supply system in the adjacent Town of Atkinson, in conjunction with source control and/or natural attenuation measures, as a preferred alternative.

The Site is located over an aquifer which is used for the Town of Plaistow's drinking water supply. The State of New Hampshire has designated the aquifer as being of "High Value." An interim alternate water supply is not a substitute for active restoration.

A feasible alternate water supply has not been identified to date, resulting in the installation of point of use treatment systems to affected residents, rather than the preferable connection of these residents to a 'clean' supply. However, the point of use treatment systems have proven to be an effective method for treating groundwater contaminants to non-detectable levels and will continue to be utilized until aquifer restoration is complete.

While measures such as containment and attenuation have proven protective and effective at other Superfund sites, it is not an acceptable approach for the Beede Site. Given the existing aquifer users in the immediate area, continued migration of the plume, absence of an alternative supply within the Town and the designation of the aquifer by the State of New Hampshire as "High Value," active restoration must be implemented to best reduce risks identified in the Proposed Plan and ROD.

9. The commentor believes there exists a lack of scientific and economic justification for actively addressing the smear zone. The commentor points to the apparent simplified leaching model developed in the FS as questionable. The commentor suggests applying a standard leaching model and then assessing the need for treatment of the smear zone following completion of the currently operating LNAPL vacuum extraction system.

   Groundwater must be restored to drinking water standards. This goal can only be accomplished in conjunction with effective source control measures which involve removing VOCs from the smear zone. See response to comment IV.A.1 for more detail.

10. The commentor states that there does not appear to be any basis to warrant removal of the sediment. No sediment cleanup goals are established in the FS or Proposed Plan. The commentor further points out that it is not uncommon to utilize natural attenuation in preference of active cleanup to avoid significant disturbance.

    The sediment area to be addressed has already been highly disturbed by prior Site activities. See response to comment IV.B.2.

11. The commentor believes that the existing free product (or LNAPL) removal system has been ignored requiring abandonment prior to installation of a new thermally-enhanced treatment. More effort should be given to utilizing the existing system.

    The existing LNAPL system components, wells and conveyance system can be utilized to the extent practical once EPA determines that the NTCRA is complete.

    The LNAPL recovery system was installed as a non-time critical removal action necessary to prevent further seepage of oil to Kelley Brook, stop expansion of the oil plume and remove an obvious source of ongoing groundwater contamination. The need for thermal enhancement to address VOCs contained in the smear zone was not envisioned at that time and was well beyond the scope of the LNAPL removal design. See response to comment IV.B.3.

12. The commentor believes that EPA's proposed remedial strategy, which includes source control, management of migration control and active groundwater treatment, is inherently redundant. The commentor advocates a reliance on source control with limited containment around the primary plume area and attenuation of secondary plume areas as a more targeted approach.

    EPA believes that the proposed remedial strategy appropriately combines source control and management of migration measures to address the principal threats at the Site in a manner which is protective of public health and the environment.

These actions are complimentary, and not redundant. See response to comment IV.B.5.

13. The commentor notes that the in-situ treatment option (thermally enhanced SVE) uses the full volume of the "cool zone" (<1ppm PCBs, non-hazardous lead, and VOC concentrations which are not likely to leach) in the deep and smear zone soils. The commentor believes the resulting soil volumes may be greatly overstated when viewed from a risk-perspective.

The justification for the treatment of deep soils (i.e. soils deeper than 10 feet below ground surface and/or smear zone soils) is not risk-based.

Deep soils contain numerous contaminants including VOCs, PCBs, PHCs and lead but must be treated to remove onlyVOCs, to prevent further leaching to groundwater. The volume of deep soil to be treated is a conservative estimate since only limited analytical data is available. The estimate is based primarily on the size of the smear zone, which serves as a primary source of subsurface VOC contamination. The need for further characterization of deep soils will be assessed in the pre-design phase.

14. The commentor believes that soils are amenable to treatment through stabilization and on-Site disposal without introducing a public health or environmental risk. The commentor believes this option was incorrectly eliminated from consideration based on an interpretation that any on-Site disposal would constitute a solid waste landfill that would have to be located more than 500 feet from the nearest resident. The commentor notes that the on-Site construction of disposal cells for stabilized waste has not been subject to solid waste landfill regulations at similar sites in Region 1.

Stabilized waste in soil left on-Site would constitute a solid waste disposal area. The 500 foot set-back is a State requirement under Env-Wm 2504.04(c). EPA does not have regulatory authority to 'relax' this requirement. In addition, see response to comment IV.C.6.

15. The commentor notes that deep soil contamination extends about 30 feet below ground surface, with the lowermost 5 to 10 feet below the groundwater table. The use of thermally-enhanced SVE will require that the entire impacted area be dewatered during treatment. This adds considerably to the complexity and cost of the remedy and further reduces the overall efficacy of the Proposed Plan.

Dewatering is a typical requirement for the effective treatment of VOCs in deep soil, regardless of the applied technology. Dewatering which will occur during operation of the groundwater extraction and treatment system under MOM-3 may be

adequate and therefore not add to the cost of the overall remedy. The need for additional dewatering beyond that afforded by the groundwater extraction and treatment system will be assessed during pre-design.

16. The commentor notes that the percentage of Site soil considered to be hazardous was based on an early State mixture rule that is no longer in effect. Only 3 of 22 soil samples were found to exceed total characteristic leaching potential ("TCLP") for lead. Therefore, the commentor concludes that the soil volume judged to require off-Site disposal as a hazardous waste are likely overstated.

Soil volumes contained in the FS were calculated based on best available information for the purpose of developing a conceptual cost estimate. The need for more accurate volumes, and perhaps updated information, will need to be assessed during the pre-design process. In the end, sampling results gathered during performance of the remedy will dictate final disposal options.

17. The commentor notes that construction of a slurry wall was not considered feasible due to the presence of a 50 foot thick till layer before bedrock is reached. The commentor believes the till itself would be an effective unit barrier in which to key the slurry wall.

The integrity of the till to perform as an effective barrier is uncertain at best. The bedrock underneath the Site is highly fractured. Containment strategies were eliminated since restoration of the aquifer is required.

18. The commentor believes that the proposed groundwater monitoring program is excessive given that it includes 16 sentry wells at and beyond the downgradient edge of the existing plume, as well as 50 wells deemed necessary by the State to monitor the groundwater management zone.

See response to IV.C.5.

19. The commentor quotes from the FS;

> "With an effective SC [soil] alternative, groundwater (Site-wide and at impacted wells to the south of Parcel 2) is estimated to attain ambient groundwater quality standards ("AGQS") for VOCs in approximately 40 years."

The commentor is referring to alternative MOM-2, which is natural attenuation. MOM-3 and MOM-4 are estimated at 15 and 35 years respectively. The commentor believes that the selection of MOM-3 will require an additional $15 million to achieve only a 50% reduction in overall cleanup time.

A time-frame of 40 years for aquifer restoration (natural attenuation/MOM-2) is inconsistent with the designation of the aquifer as "High Value" by the State of New Hampshire. Under MOM-3 (i.e., high pump rate), currently impacted wells to the south are expected to be restored to drinking water standards within 5 years, whereas this will take 12 years under MOM-4.

D. *Lawrence Gill (Plaistow Conservation Commission) Comments*

1. The commentor questions why the recharge wells are located where they are, and what's the purpose of locating them there?

An estimated forty vertical infiltration wells are planned for a wooded area along the western portion of parcel 1. Each of the 12 inch diameter wells would infiltrate about 5 gpm, therefore forty wells are necessary to accommodate the estimated 200 gpm treatment system capacity. The wells are located in this area of the Site since it is upgradient of the source area and will serve to help flush the plume towards the extraction wells.

2. The commentor wants to know how the removal of sediment from Kelley Brook and the extraction of groundwater will affect wildlife and downstream wetlands?

The removal of approximately 1,100 cubic yards of contaminated sediment from the former oil breakout area is not expected to have a negative impact. Sheet piling will be used to prevent further release of contaminated sediments during excavation. Following excavation, the area will be replaced with wetland soils and re-vegetated. Downstream surface water and overall wetland quality is expected to improve as a result of this action.

The extraction of groundwater is not expected to have a negative impact on the Kelley Brook wetland system. The extraction wells have been conceptually located such that at the planned pumping rate of 85 gpm, no significant impacts to Kelley Brook are anticipated. However, some infiltration of surface water may occur. Surface water elevations will be observed and wetland quality monitored.

3. The commentor notes that EPA may consider discharge of treated groundwater directly to Kelley Brook and wants to know how that would be done and what impacts may result downstream?

Discharge of treated groundwater directly to Kelley Brook through a dedicated pipe has been considered. Surface water discharge has many advantages over groundwater infiltration and, in general, is more reliable and cost-effective. Monitoring of Kelley Brook would be performed to ensure that no negative impacts

occur. Discharge standards of acceptable water quality and flow rate would need to be determined in order to meet requirements set by DES. Since Kelley Brook is a small stream, discharge standards would likely be extremely low (i.e., less than drinking water standards) and possibly unattainable. Also, the acceptable flow rate may be too low to accept the necessary effluent.

This discharge option is dependant upon the final extraction rates and resulting surface water discharge standards to be determined following completion of the aquifer pump tests. A final decision will be made during the design phase.

E. *Cathy Corkery (New Hampshire Sierra Club) Comments*

1. The commentor gave a statement of general support for the proposed EPA and DES cleanup plan and applauded the Plaistow community for their efforts.

F. *Frank Banaski (abutter) Comments*

1. The commentor gave a statement of general support for the proposed EPA and DES cleanup plan. The commentor wanted to remind everyone that the Site must be cleaned up to residential standards.